Mining CONGRESS JOURNAL

APRIL
1958

1958

COAL CONVENTION

Cincinnati, Ohio, May 5-7

Better Metallurgy For Fewer Dollars with

DENVER "Sub-A"

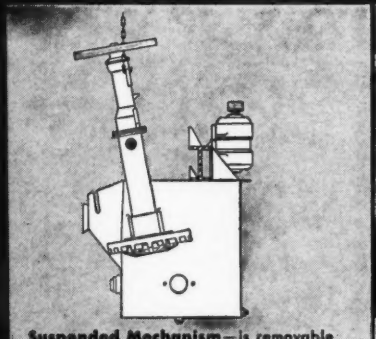
Greater Tonnage in Less Space... At Less Cost Per Ton

When you specify DENVER Flotation, you get equipment that reflects...

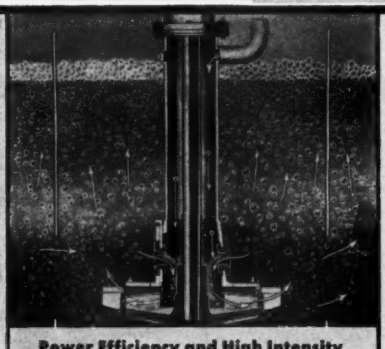
- **Up-to-date Engineering** to take advantage of progress in materials and manufacturing techniques.
- **Up-to-date Design** and the advantage of distinctive features.
- **Up-to-date Materials** that make your equipment better, last longer, cost less.
- **Up-to-date Workmanship** in our own shops with the best machine tools and skilled mechanics.
- **Up-to-date Experience** that understands today's requirements.

You benefit from over 30 years of leadership in flotation engineering, equipment design and development —advantages that add up to better recovery, better metallurgy, better profits.

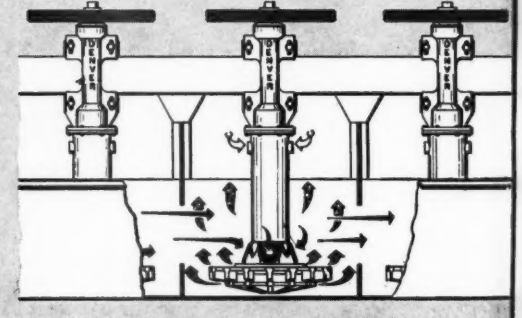
DENVER "Sub-A"—World's Leading Flotation Machine for Roughing, Cleaning and Scavenging.



Suspended Mechanism—is removable as one unit. Can be replaced while machine is in operation to minimize down time. All wearing parts are molded rubber to resist abrasion, wear 2 to 10 times longer.



Power Efficiency and High Intensity Aeration means efficiency throughout entire cell volume. High mechanical aeration is accomplished with substantial savings in power.



Free Flow Cell Design permits simplicity, low cost, high flotation efficiency, superior metallurgy, higher profits.

Lower initial cost, lower installation cost, longer part life, lower horsepower, lower operating cost, lower part life cost—don't overlook these vital UNSEEN factors in flotation. Here's where your profits lie. Try DENVER Flotation in your mill. Your economic success is assured by DENVER'S proved, world-wide leadership in flotation.

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Mining

CONGRESS JOURNAL

APRIL, 1958

VOLUME 44 NUMBER 4

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Opinions expressed by authors within these pages are their own and do not necessarily represent those of the American Mining Congress

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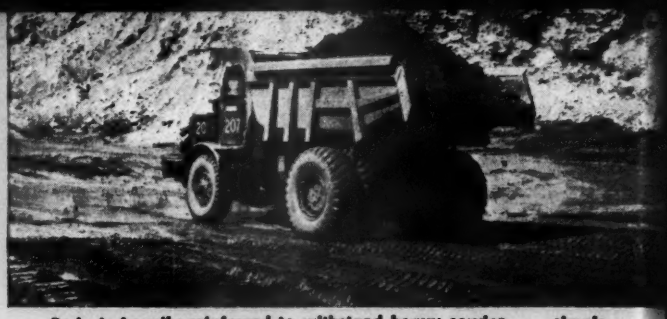
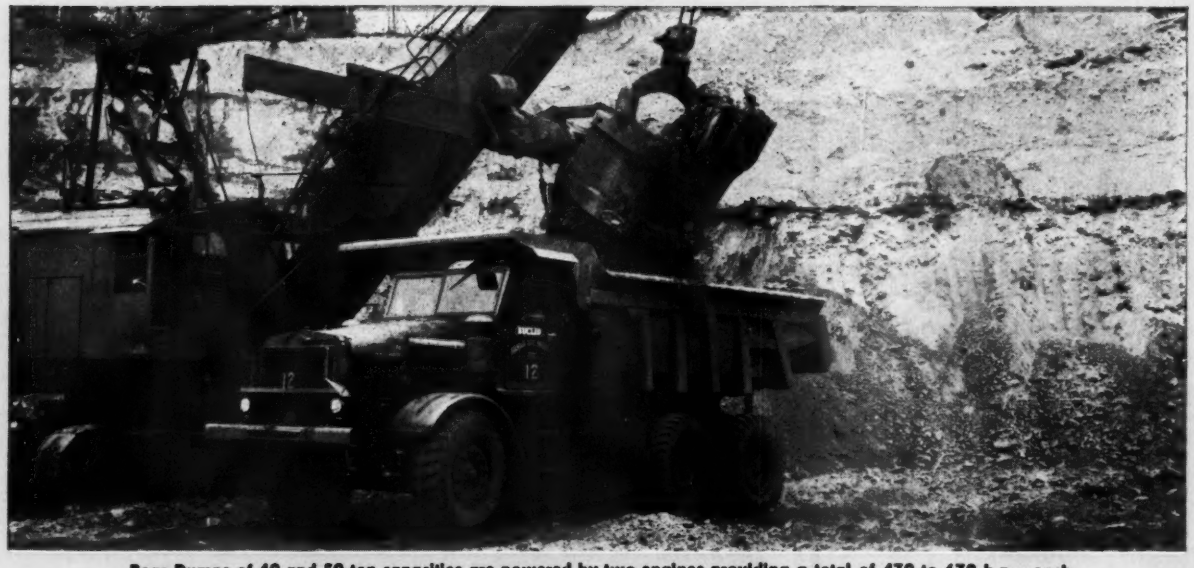
High dumping angle and smooth body interior sheds the load fast and clean . . . note distance of rear body chute from wheels.



Body is heavily reinforced to withstand heavy service . . . simple, rugged construction of "Eucs" keeps maintenance costs low.

More Ore on the Mesabi is Moved in "Eucs" *. . . and always has been!*



Rear-Dumps of 40 and 50-ton capacities are powered by two engines providing a total of 470 to 670 h.p.—each engine drives one of the tandem axles through a separate torque converter and semi-automatic transmission.

MINNESOTA'S IRON RANGE is a tough proving ground for off-highway hauling equipment. Loaded by big shovels, trucks haul ore and rock in all kinds of weather—often on steep grades and long, difficult hauls. They've got to maintain production at low operating and maintenance cost or they don't stay on the job long.

For over 20 years Euclids have moved far more tonnage on the range than all other competitive makes. Mine operators know from years of experience that they can depend on "Eucs" for long life in heavy service—with low operating and maintenance expense. That's why Euclids are "standard" equipment on so many mine and quarry operations—with over 1300 Rear-Dump "Eucs" of 15 to 50 tons capacity working in Minnesota alone.

Have a Euclid dealer give you information on the complete line of rear-dump and bottom-dump haulers, scrapers and crawler tractors. He'll help you with your hauling problems and show you why ***Euclids are your best investment.***

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

27 TON pull test shows 4-way expansion of O-B Shell and Plug!

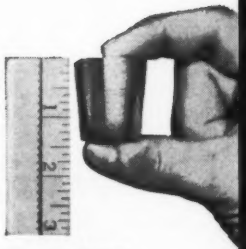
On the left, a plug from an O-B Bail-Type expansion unit. On the right, an identical plug after tensioning to 54,000 pounds — *6 times* the normal bolt load!

The test was made with a special bolt installed in a 1⅜ inch hole drilled in quartzite by an O-B customer operating a South African gold mine.

As shown in these unretouched pictures, the plug was compressed 22% and elongated over 30% by the tremendous pressures exerted against it. But, because those expansion pressures were distributed evenly four ways, reducing unit stresses to an absolute minimum, the O-B plug refused to break and release the bolt.

Four-way expansion is *another* reason why "they go up easy *and stay put!*"

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co. Ltd., Niagara Falls, Ont.



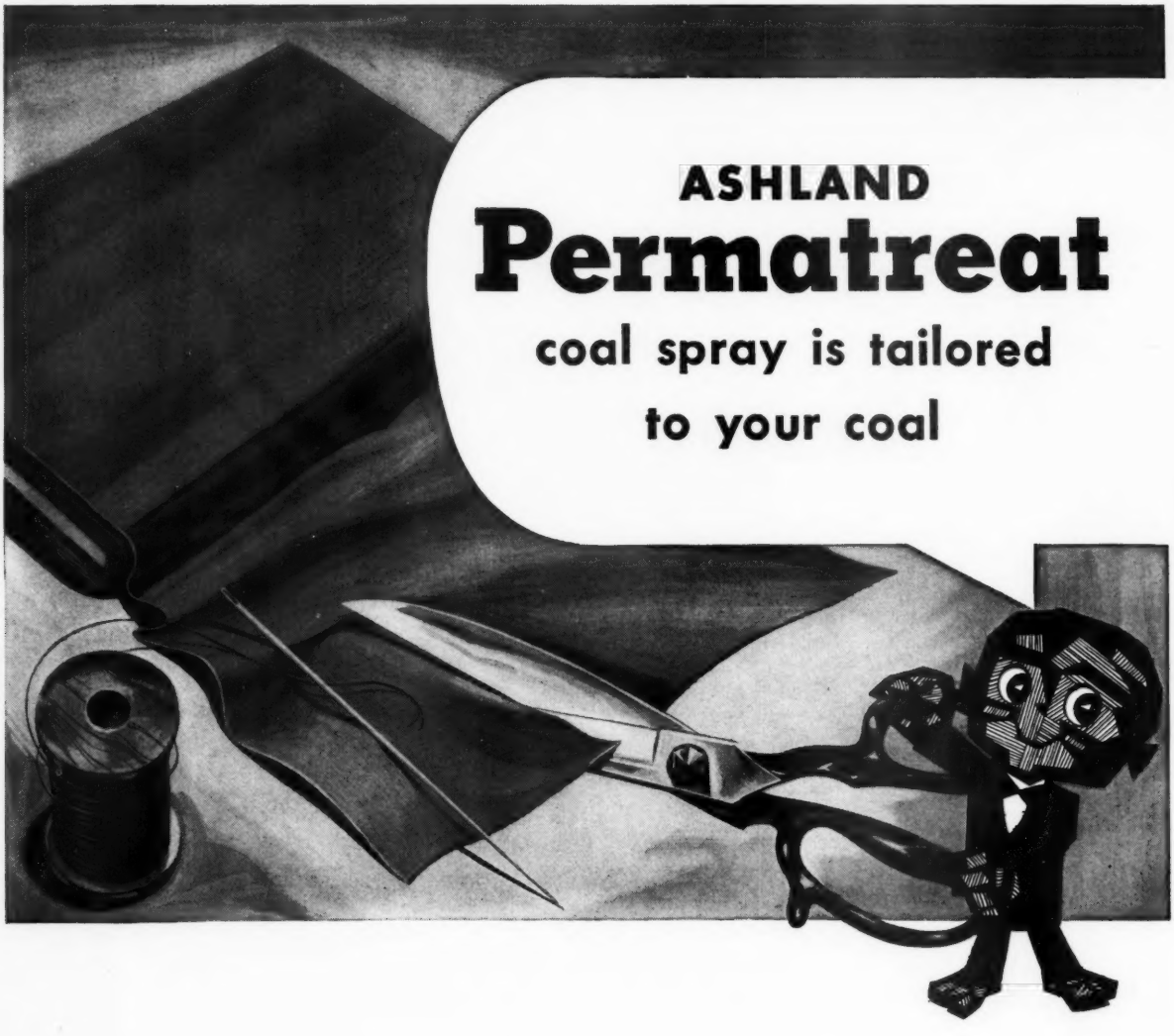
PLUG BEFORE TEST

PLUG AFTER TEST

Ohio Brass

O B
SHELLS AND PLUGS

4827-M



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coal spray is tailored to your coal

Permatreat coal spray is an oil carefully refined and formulated to solve the particular problems of treating your type of coal.

When your coal is sprayed with Permatreat, it becomes freeze-proof, water-proof, dust-proof and non-corrosive.

It ships and handles easier . . . stockpiles longer . . . and resists windage losses.

Convenient supply points assure immediate delivery. Yours for the asking—our special technical, research and consultant services. Just write, wire or phone us.

One* Permatreatment *lasts the life of the coal!

ASHLAND OIL & REFINING COMPANY
Ashland, Kentucky

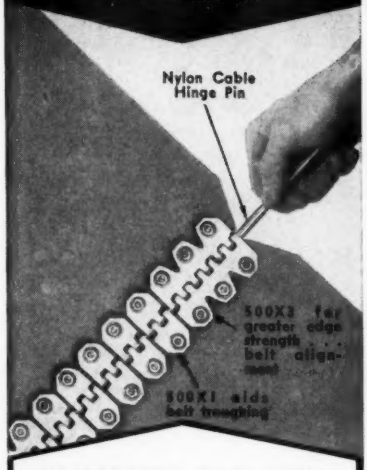
Ashland PERMATREAT

WHERE SPEED COUNTS...

use

FLEXCO®

HINGED 500X BELT FASTENERS



UNDERGROUND COAL MINING

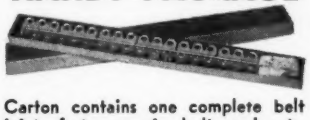
THE IDEAL FASTENER FOR JOINING EXTENSION BELTS. DESIGN PERMITS THE USE OF A SMALLER FLEXIBLE NYLON CABLE HINGE PIN FOR SMOOTHER, TIGHTER JOINTS.

NYLON CABLE HINGE PIN . . .

- Easy to insert or pull out . . . will not migrate.
- Smooth wearing surface—nylon is self-lubricating.
- Will not unravel when cut.

Start now to equip your extension belts with FLEXCO 500X "SEPARABLE" FASTENERS (new FLEXCO HINGED 500X FASTENERS are interchangeable with old HF 500 Fasteners).

HANDY PACKAGE



Carton contains one complete belt joint—fasteners, pin, bolts and nuts.

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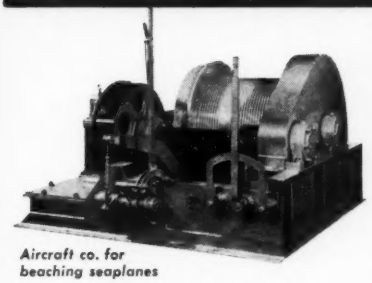
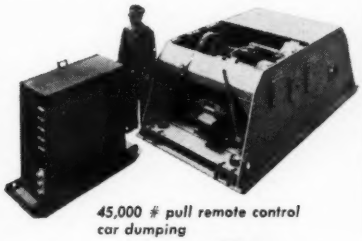
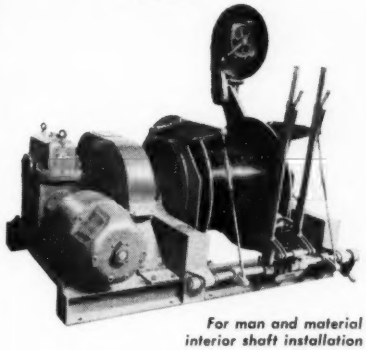
Worm Drive Hoists



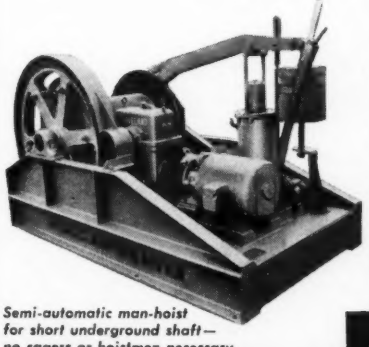
Aircraft co. for beaching seaplanes



45,000 # pull remote control car dumping



For man and material interior shaft installation



Semi-automatic man-hoist for short underground shaft—no cagers or hoistmen necessary.

These slow-speed hoists have many jobs: . . . driving long raises, car spotting, underground hoisting, short distance and semi-automatic skip operating, car dumping, smelter furnace charging, pump equipment hoisting, docking sea planes and others.

There are many Vulcan designs and sizes from five to 50 thousand pounds pull. Optional features include magnetic brakes, gravity set or manual post type brakes, mechanical clutches, depth indicators, remote controls, etc. Some of these slow-speed hoists have been fully designed and equipped for semi-automatic skip and man-hoisting. All are the typically rugged construction and compact design for which Vulcan has long been known.

Let our engineers show you how a Vulcan design can solve your hoisting or winching problems, quickly, efficiently and economically.

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IN DENVER SINCE 1891

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58 NORDBERG GRINDING MILLS in Ore Concentration Plant

. . . largest iron ore mill installation under one roof in the world

Here, stretching about a quarter of a mile, are 27 Nordberg Rod Mills and 27 Nordberg Ball Mills in a concentrator building up in the Lake Superior Iron Range of Minnesota. The 54—10 foot diameter Nordberg mills reduce hard, abrasive Taconite Iron Ore to the fineness of flour. Four additional Nordberg mills serve as reserve replacement units.

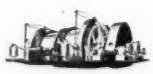
This is but one example of the way in which Nordberg Grinding Mills, in sizes from 6 to 13 feet in diameter and up to 50 feet in length, are successfully serving the ore, mineral, cement and chemical processing industries of the world.

Years of specialized experience in the design, manufacture and installation of process machinery assure you that you can count on Nordberg, its machinery and "know how" to add efficiency and economy to *your* processing operations. For complete details, write for the Nordberg Grinding Mill Bulletin 232.

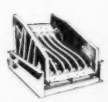
NORDBERG MFG. CO., Milwaukee 1, Wis.

SYMONS PRIMARY GYRATORY CRUSHERS

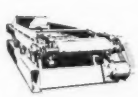
SYMONS CONE CRUSHERS



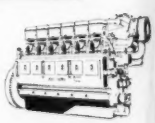
NORDBERG MINE HOISTS



SYMONS GRIZZLIES and SCREENS



SYMONS VIBRATING SCREENS



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GM158

Only a 50% Grounding Wire gives 100% protection

—And Anaconda's flat 50% Grounding Wire offers full electrical protection with small diameter!

To get full electrical safety protection it is necessary to have a full 50% grounding wire. Anaconda Shuttle Car Cable gives you that—and much more!

The Anaconda *flat* 50% wire offers an extra safeguard . . . it will not cut insulation if cable is crushed by runovers.

NEW FLAT STRANDING of grounding conductor prevents broken wires—assures continuity of operation. Full 50% wire delivers maximum electrical protection.

Millions of feet of Anaconda Shuttle Car Cable have been sold without a single reported failure of grounding conductor.

The flatness of Anaconda's cable is important, too: better reeling, more cable on a reel!

4 REASONS WHY ANACONDA IS THE MOST ECONOMICAL CABLE YOU CAN BUY!

1. The only cable with rugged high-grade *neoprene insulation* that greatly increases resistance to puncture, flame and crushing.

2. Patented nylon breaker strip that reduces short circuits.

3. Improved stranding of ground and power conductors that increases flexibility and prevents broken wires.

4. Nylon seine twine jacket reinforcement prevents wicking of moisture, gives jacket greater tear resistance.

The Man from Anaconda or your Anaconda distributor will be glad to give you full information. See him today. Or write: Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

58818

LIVE BETTER ELECTRICALLY

SEE THE MAN FROM **ANACONDA**®

FOR **SHUTTLE CAR CABLE**

Worried about rock falls? Bolt the roof!

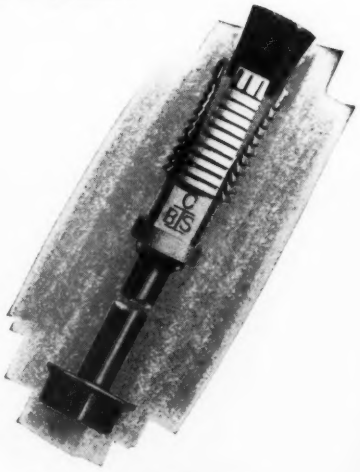
An ideal way to minimize the danger of severe rock falls is to use Bethlehem headed roof bolts. Used with leaf-type expansion shells, these long bolts control the roof because they lock themselves in drilled holes, anchoring the overlying strata into a supporting beam.

In addition to promoting safety, Bethlehem roof bolts permit wide openings and clearances, enabling mechanized equipment to work close to the face. Ventilation is improved, due to the absence of bulky supports. There's less need for storage space, both above and below ground. And there is no fire hazard to worry about.

Headed Bolts Made in Three Types

Bethlehem headed roof bolts come in these three diameters: ¾ in. carbon, typical breaking load 24,000 lb; ⅝ in. high strength, typical breaking load 24,000 lb; ⅞ in. high strength, typical breaking load 45,000 lb. We also produce a 1-in. slotted roof bolt, which is used with a steel wedge.

If you would like full information about Bethlehem roof bolts and accessories, get in touch with the nearest Bethlehem sales office.



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

2 big reasons why:

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NON-EXPLOSIVE MINING METHOD

is used at KING STATION MINE

Home of DEEP VEIN COAL

According to Henry P. Smith, of Princeton Mining Company, AIRDOX Methods are used because . . .

AIRDOX

NON-EXPLOSIVE MINING METHOD

Cuts Costs 5 Ways

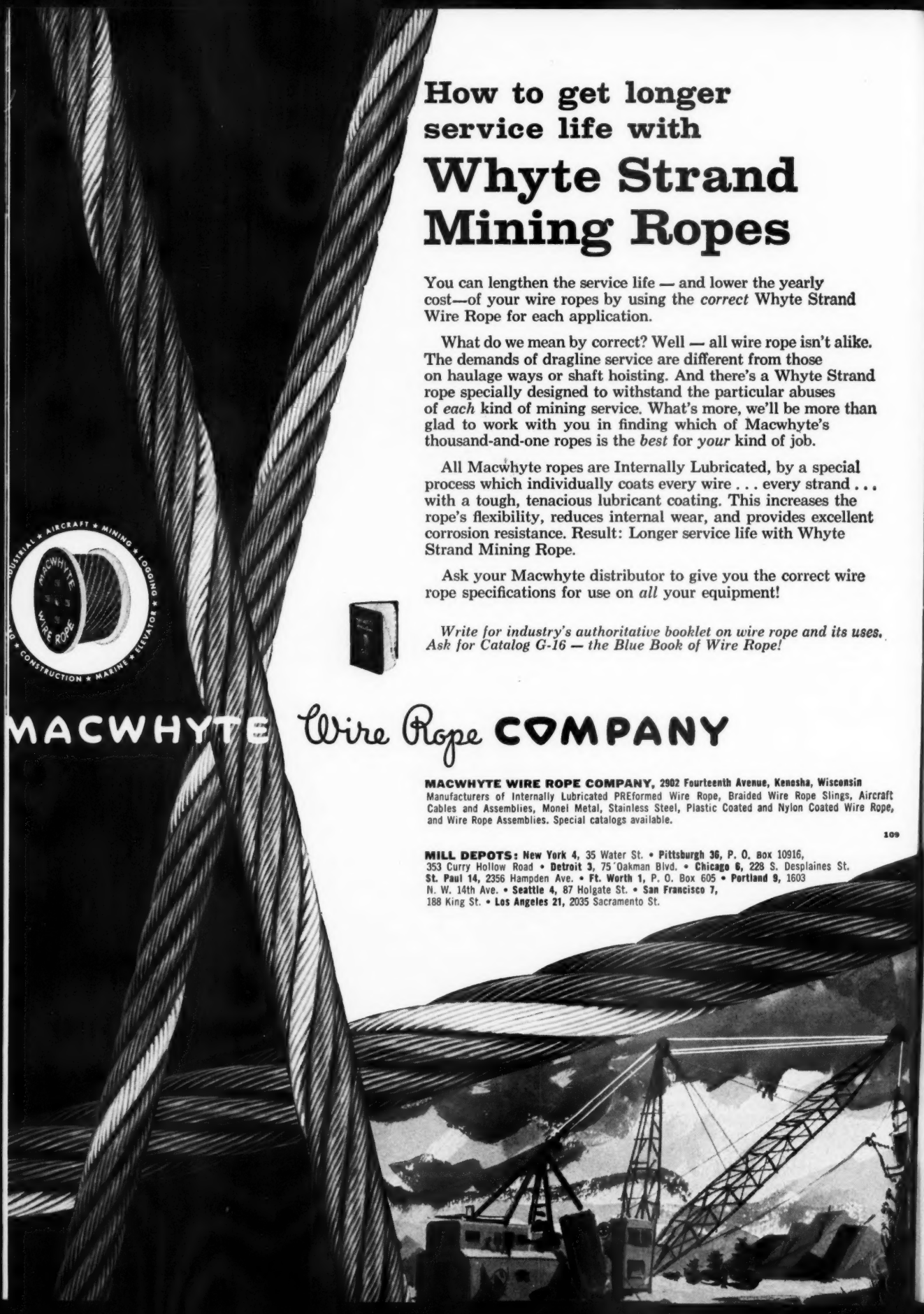
- Produces less fines in face preparation
- Rolls coal forward for faster, easier loading
- Easier on "tender" roofs—cuts timbering, bolting
- Lowers cleaning costs by minimizing fines
- Reduces degradation—no shattered coal

1 **Safety...** Our miners' safety is uppermost in mind. Also, AIRDOX permits us to shoot while the men are working down below, which is an advantage in the working of the mine.

2 **Preparation...** Deep Vein is primarily a domestic coal and as such must have eye appeal and be able to store with the minimum of degradation — only with the use of AIRDOX is this possible.

HENRY P. SMITH, President
Princeton Mining Company

AIRDOX CORPORATION • 302 NORTH MICHIGAN AVENUE • CHICAGO 1, ILLINOIS



How to get longer service life with Whyte Strand Mining Ropes

You can lengthen the service life — and lower the yearly cost—of your wire ropes by using the *correct* Whyte Strand Wire Rope for each application.

What do we mean by correct? Well — all wire rope isn't alike. The demands of dragline service are different from those on haulage ways or shaft hoisting. And there's a Whyte Strand rope specially designed to withstand the particular abuses of *each* kind of mining service. What's more, we'll be more than glad to work with you in finding which of Macwhyte's thousand-and-one ropes is the *best* for *your* kind of job.

All Macwhyte ropes are Internally Lubricated, by a special process which individually coats every wire . . . every strand . . . with a tough, tenacious lubricant coating. This increases the rope's flexibility, reduces internal wear, and provides excellent corrosion resistance. Result: Longer service life with Whyte Strand Mining Rope.

Ask your Macwhyte distributor to give you the correct wire rope specifications for use on *all* your equipment!

Write for industry's authoritative booklet on wire rope and its uses. Ask for Catalog G-16 — the Blue Book of Wire Rope!

MACWHYTE Wire Rope COMPANY

MACWHYTE WIRE ROPE COMPANY, 2902 Fourteenth Avenue, Kenosha, Wisconsin
Manufacturers of Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal, Stainless Steel, Plastic Coated and Nylon Coated Wire Rope, and Wire Rope Assemblies. Special catalogs available.

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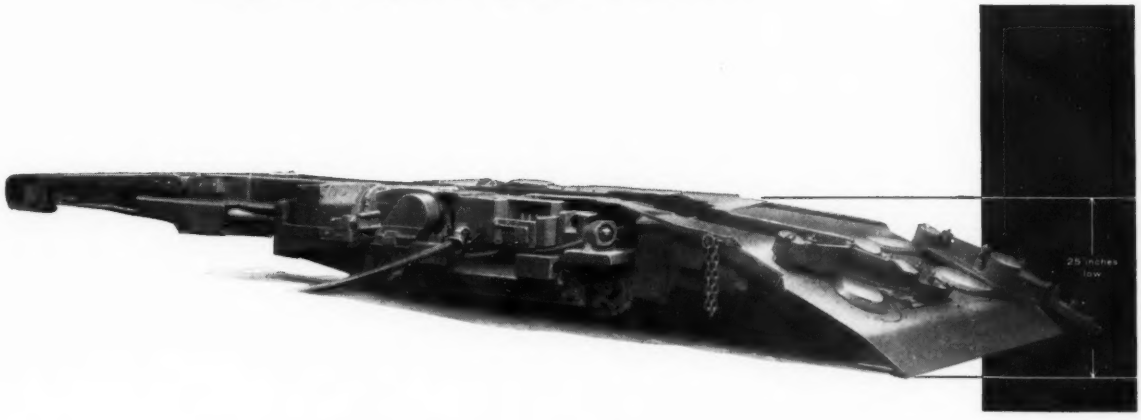
for high capacities
in low seams...
400 tons per shift



JEFFREY 81-C Loaders

Gathering head on Type 81 Jeffrey crawler loaders is fully gear driven; no chain drives between head motors and gathering arms.

Just 25 inches high, this newest Jeffrey crawler loader is ideally suited for low seam work. Offers the same time-tested features that made Jeffrey's 81-A and 81-B loaders so popular . . . fast, easily maneuvered, highly productive.

The Jeffrey 81-C loader is powered by four 15 HP electric motors and a 4 HP hydraulic motor . . . power for the toughest jobs. It has a rated capacity from 6 to 10 tons per minute . . . averaging 400 tons per shift in 33" seams, keeping loading costs to a minimum. Moves fast from place to place, hits loading stride quickly and stays on the job until the work is done.

Like all Jeffrey mining machinery, Jeffrey loaders are available for either AC or DC power. With Jeffrey equipment you can make your mine all-AC.

Flexibility built into the Jeffrey loader lets it work most efficiently with other face equipment and the same mining cycle. Conveyor swings 45° either side of center and elevates properly to load shuttle cars on the straight or in break-throughs. Can be turned in its own length.

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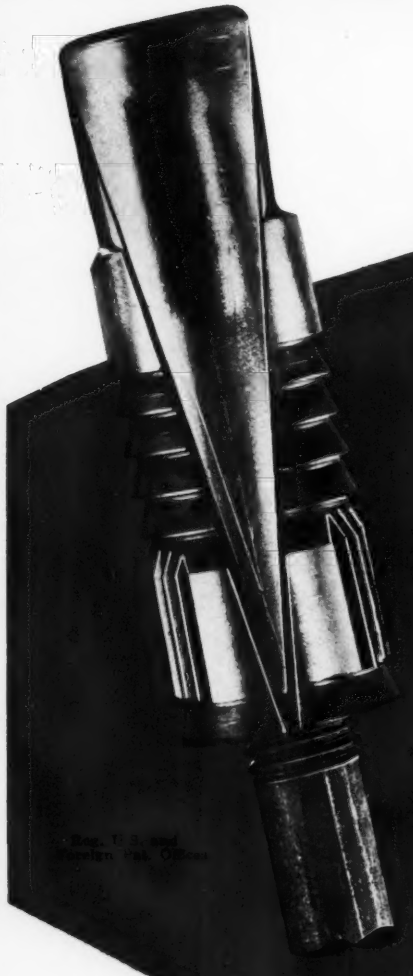
958 North Fourth Street, Columbus 16, Ohio

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING



In Western States

PATTIN expansion shells are available and serviced exclusively through Colorado Fuel and Iron Corporation, Denver, Colorado. Western mining companies may contact them direct for information and consultation.

PATTIN

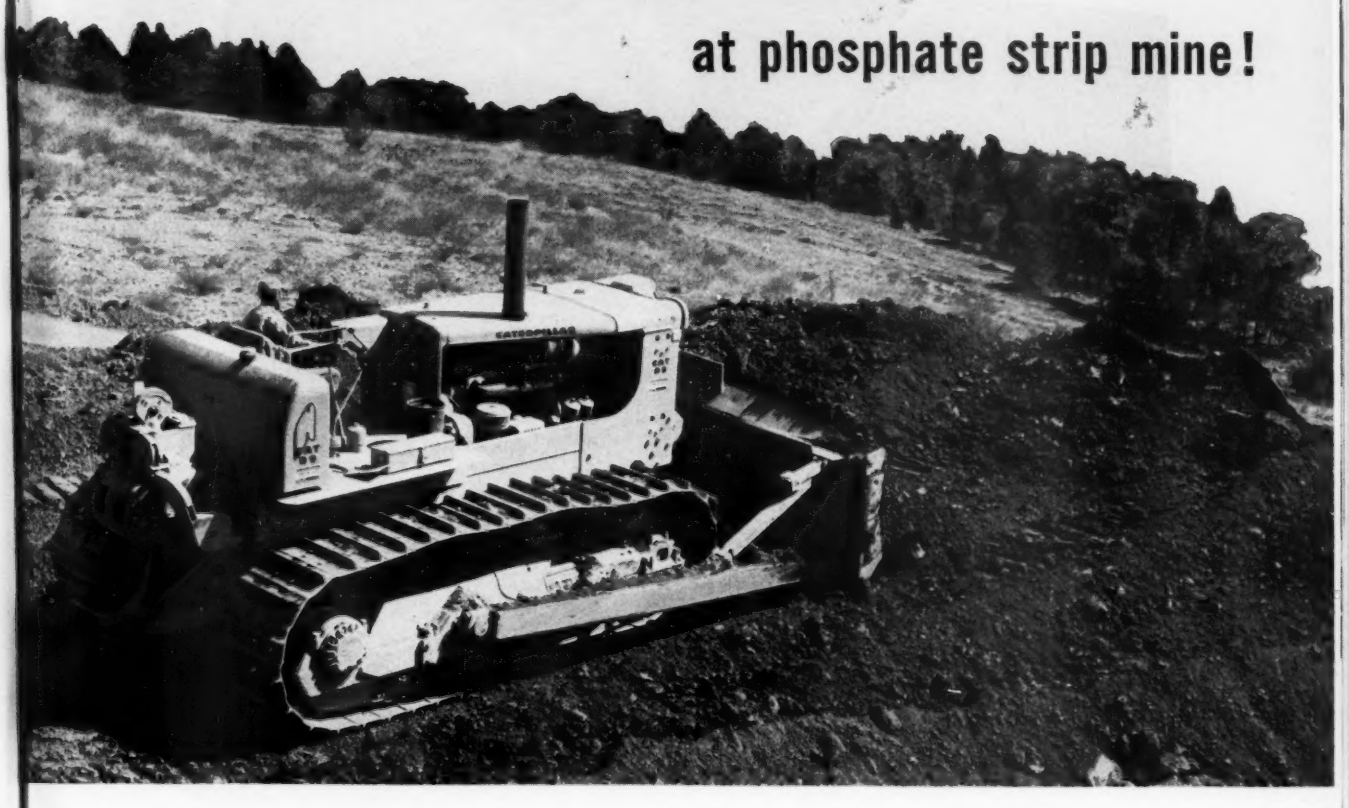
"69th Year"

MANUFACTURING COMPANY

MARIETTA, OHIO

D9 DOZES 4,000 CU. YD. OF OVERBURDEN PER 10-HOUR DAY

at phosphate strip mine!



Here's the remarkable record being made by this giant CAT* D9 Tractor with No. 9S Bulldozer on a phosphate strip mine near Columbia, Tennessee:

—Averages 16 cu. yd. per 150-ft. pass dozing overburden to spoil bank.

—Makes 25 passes per hour, working a 10-hour day.

—*Total: 4,000 cu. yd. of overburden moved daily.*

And this king-sized production output is not the whole story. The D9 benches for a 3-yd. Lima dragline—working ahead maintaining a 15 to 18-ft. shelf for dragline footing.

No wonder Malcolm C. West, owner of the mining contracting firm on this operation, says: "You need a volume of overburden to make a profit—and I think the D9 is the only dozer capable of doing the job."

That's the story at mine after mine. When the D9 goes into action, owners wonder how they ever got along without it! Dozing, the D9 can sometimes outwork 2 bulldozers of the next smaller size. With its massive weight and 320 HP at the flywheel, the D9 digs in and pushes bigger loads faster than many new users had believed possible.

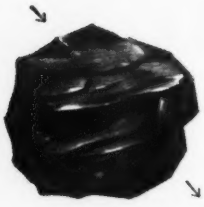
Your Caterpillar Dealer is ready to show *you* on your job exactly how the Caterpillar D9 Tractor can give you high production at low cost per yard. And he's ready, too, to stand behind the long life of this dependable machine with prompt, reliable service and parts you can trust.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

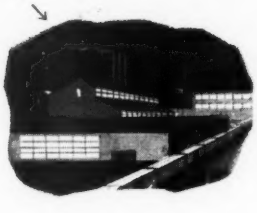
WANTED—
THE HARD WORK



Designed, Engineered and Built

to prepare YOUR coal . . .

to satisfy YOUR customers . . .



your Roberts & Schaefer Plant

Your customers come first in the thinking of R&S engineers when they design your coal cleaning plant.

Your plant must be engineered specifically to prepare *your* coal to satisfy the exacting requirements of *your* customers. It must have the flexibility and capacity to meet varying market demands and the design and equipment to assure efficient, economical operation.

You can depend on the Roberts & Schaefer organization for the creative engineering skills, long experience in the coal field, and resources and facilities required to design for you a plant that will meet your exact requirements.

Roberts & Schaefer has pioneered many new developments in plant design and in coal preparation facilities and provides a comprehensive service including initial process studies, structural, mechanical and electrical design, installation and construction.

When you plan your next plant, or need to modernize your present operations, call Roberts & Schaefer.

ENGINEERS & CONTRACTORS

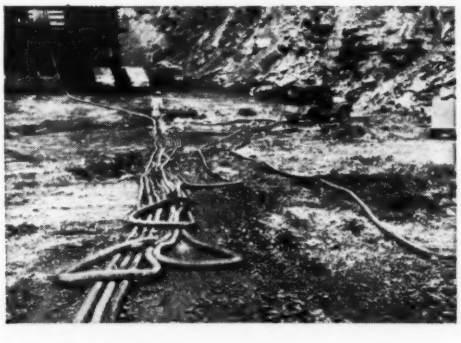
ROBERTS & SCHAEFER *Company*

130 NORTH WELLS STREET, CHICAGO 6, ILLINOIS

NEW YORK 19, N.Y. • PITTSBURGH 22, PA. • HUNTINGTON 10, W. VA. • ST. PAUL 1, MINN.

GENERAL CABLE

SUPER SERVICE
PORTABLE POWER CABLE



KEEPS THIS 2900-TON SHOVEL ON THE JOB

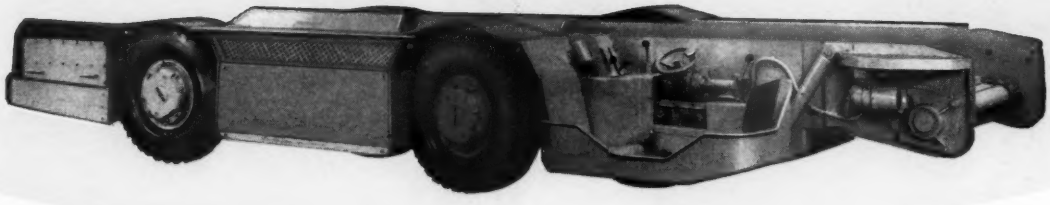
Simco-Peabody Coal Company's mammoth Marion Type 5760 shovel, shown in operation at Coshocton, Ohio, proves once again that General Cable's Super Service Portable Power and Mining Cable can really take it under severe operating conditions. All Super Service cables have an extra-heavy-duty, mold-vulcanized *Supertuf* neoprene sheath that offers unequalled resistance to mechanical abuse, weathering, flame, oils, acids, and alkalis.

Cable that can stand up to this sort of treatment is a necessity wherever service interruptions can be costly. There's a complete line of General Cable portable power cables from 600V to 15KV, all constructed to keep your equipment on the job when the going is tough. Contact the General Cable Specialist at your nearest General Cable Sales Office and Distributing Center for complete information.

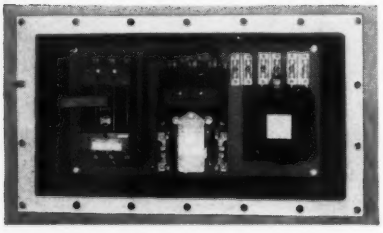
GENERAL CABLE CORPORATION, 420 Lexington Ave., New York 17
Offices and Distributing Centers Coast-to-Coast

for quality and service... **specify GENERAL CABLE**

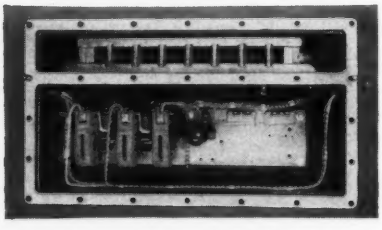
NOW, TORKAR* *economy* FOR THIN SEAMS



The NEW National Mine TorKar Type 30 A. C. or D. C. Shuttle Car



A. C. Control Panel



D. C. Control Panel

(with resistors and drilled to accommodate Ground Sentinel, if specified)

The maintenance and performance standards set by the Type 48 TorKar during the past five years now can be realized in thin seam operations. The new Type 30 TorKar (height from 30 to 36 inches) has the rugged body construction and all of the design features of the larger car. These include single A. C. or D. C. motor, efficient torque converter, three speed forward-and-reverse transmission, high-speed unloading, simplified wiring and electrical control, four-wheel drive and steering, interchangeable heavy-duty wheel units, and zoned or automatic lubrication.

For complete information on these remarkable new TorKars, consult your National Mine representative or write.

SPECIFICATIONS — Model 30

Motor: 17½ hp, A.C., 15 hp, D.C.
Base height without sideboards: 30 in.
Length with medium boom: 22 ft. 5¾ in.
Width: 95⅜ in.
Tire Size: 7.00/15
Tramming speed loaded m.p.h.: low, 1.68; second, 2.73; high 4.25
Capacity level full, cu. ft.: without sideboards, 105
Capacity level full, cu. ft.: with 6" sideboards, 154

*Trademark

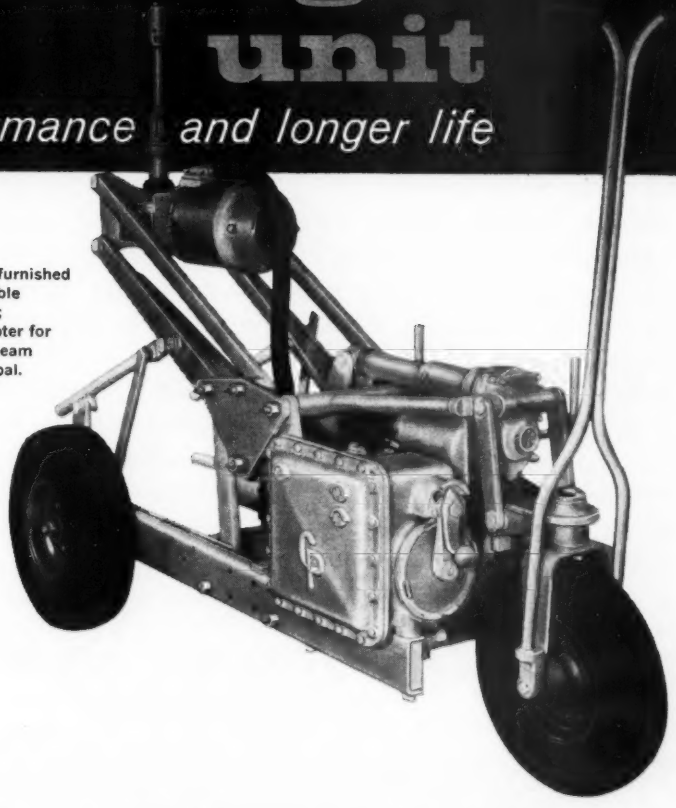
National Mine Service Company

National Mine Service Company

564 Alcoa Building • Pittsburgh 19, Pennsylvania

All-State Division, Logan, W. Va. | Anthracite Division, Forty Fort, Pa. | Ashland Division, Ashland, Ky. | Bemeco Division, Beckley, W. Va. | Clarkson Division, Nashville, Ill.
Kentucky-Virginia Division, Jenkins, Ky. | Western Kentucky Division, Madisonville, Ky. | Whiteman Division, Indiana, Pa. | Mountaineer Division, Morgantown, W. Va.

30% more motor power and
40% more gear strength give
the **NEW CP roof bolting unit**
increased performance and longer life



This new RBD-30-579 is also furnished as a self-propelled unit. Available with water swivel attachments; special low speed spindle adapter for slow speed drilling and a low seam drilling attachment for low coal.

New: motor HP stepped up 30% gives faster drilling cycle, thus cutting operating costs directly.

New: built-in cooling fan dissipates heat of enclosed motor, preserving dielectric life of insulation.

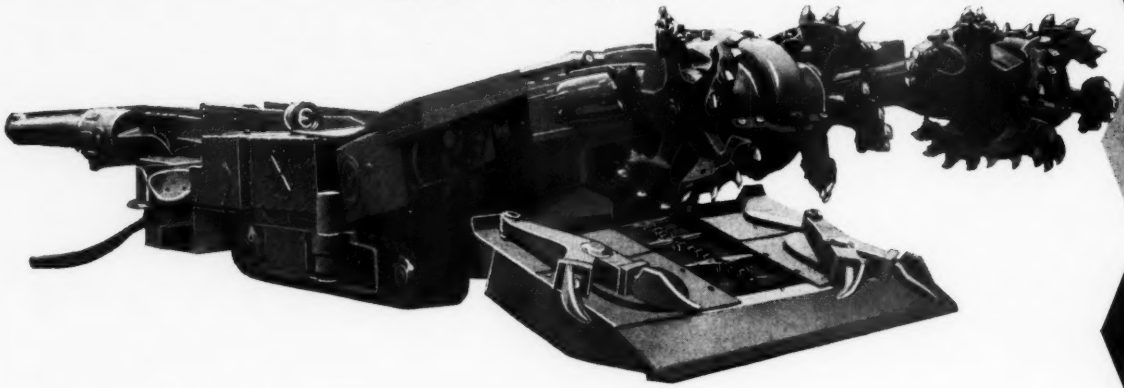
New: 40% more strength for auger and bolt setter gear train means faster drilling, quicker bolt installation and increased stamina.

And it takes the RBD-30-579 less than 3 minutes to complete an entire roof bolting cycle from drilling hole to setting expansion bolt. Low height – only 28″ – gets into low seams. Drills in slate, shale and laminated sandstone. Built-in clutch slips on overload to prevent stalling. Wheel locks hold unit solidly in operating position.

Chicago Pneumatic 8 East 44th Street, New York 17, New York

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

HERE'S WHY THOSE WHO KNOW PREFER THE *Lee-Norse* MINER



PATTERN CUTTING—*only Lee-Norse has it.*

CUTS MORE COAL WITH LESS POWER . . . *cutters revolve and oscillate at the same time—milling the coal from the face.*

CUTS A COARSE PRODUCT—FEWER FINES . . . *cutter bits follow a right and left spiral direction producing a diamond pattern which breaks off in coarse cuttings.*

A SIMPLE, STURDY MACHINE . . . *essentially a modern loading machine on which is mounted a set of efficient cutting heads.*

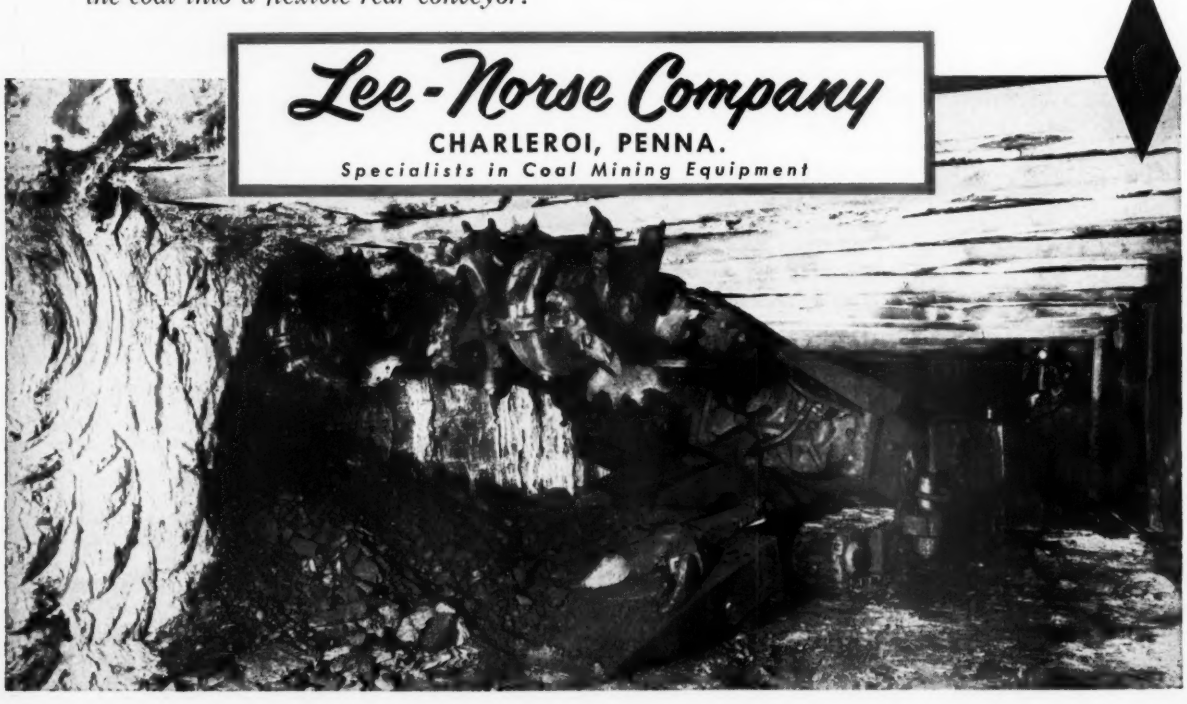
HIGHLY MANEUVERABLE—FAST TRAMMING. . . *not a "muscle-bound giant" . . . it quickly follows any variation in seam thickness.*

EXCELLENT CLEAN-UP . . . *improved dual gathering arms load all the coal into a flexible rear conveyor.*

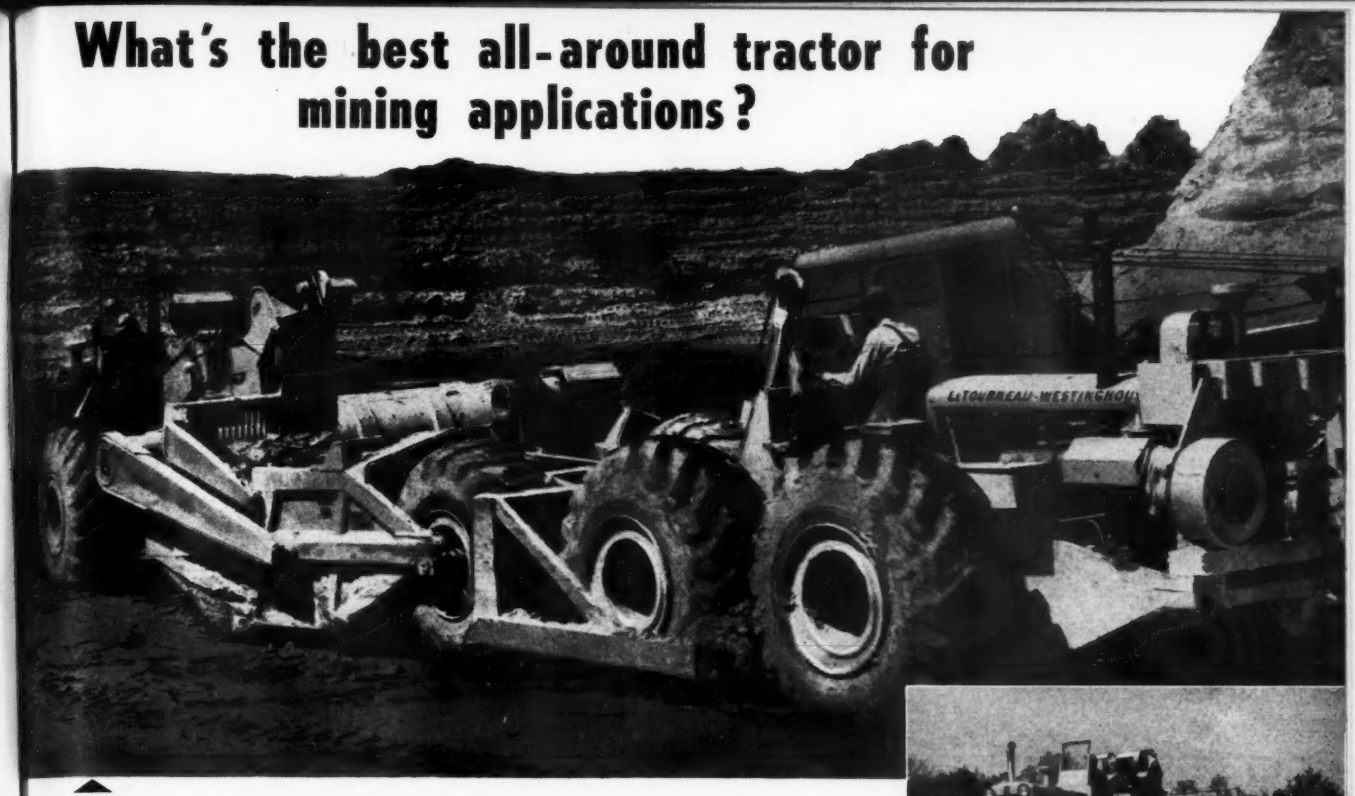
Lee-Norse Company

CHARLEROI, PENNA.

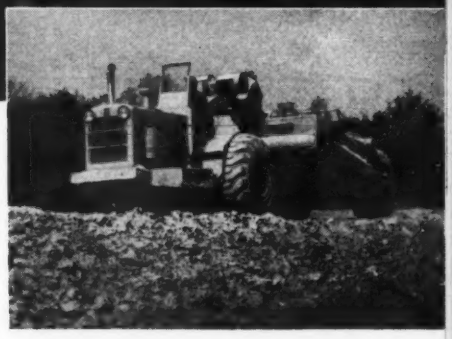
Specialists in Coal Mining Equipment



What's the best all-around tractor for mining applications?



"Tournatractor can push-load two scrapers in the same time a crawler pushes one," says Supt. Jim Vaughn, of B & B Construction Co. Stripping overburden for M & M Clays, Inc.'s kaolin pit, rubber-tired tractors helped C Tournapulls load in just 48 seconds.



Wide, low-pressure tires gave good traction and flotation in wide variety of materials encountered on project. Other Tournapull features that helped speed production included 29.9 mph travel speed, exceptional maneuverability, instant-acting electric power system.

Ask A. S. Boone — whose B & B Construction Co. does a lot of contract stripping, mining, and hauling for clay operations in the "kaolin country" around Irwinton, Georgia. He'll give you strong arguments in favor of rubber-tired LeTourneau-Westinghouse Tournatractor®.

High crawler upkeep prompted switch to Tournatractor

B & B once used only crawler tractors. But when the firm's books showed that repair bills on 5 crawlers in 1 year totaled $30,000, Boone recalls, "It was time to look for tractors that would operate in sand, clay and water without high repair costs."

Two Model D Tournapull® scrapers B & B owned had cost only $450 in repairs for over 5000 hours of work. Because Boone and his men figured rock-bottom maintenance costs should run "in the family", they bought 2 new Tournatractors. Here's what's happened:

DOWNTIME: Tournatractor downtime has been only 10 days, compared to 30 per year *per crawler.*

LUBE TIME: B & B's work records show Tournatractor can be lubed in 5 minutes . . . far less than a crawler.

REPAIR COST: When the firm bought its 2 Tournatractors, it also purchased 4 C Tournapulls and a new crawler. *The maintenance cost of all 6 L-W machines has been approximately $4500, that of the one crawler approximately $2200.*

"Does work of 2 or 3 crawlers"

Has replacing 4 crawlers with only 2 rubber-tired tractors affected production? "Yes," says Boone, *"we get a lot more done!* Tournatractor does the work of 2 or 3 crawlers." For a sample of the kind of production B & B's getting nowadays, check the accompanying work report.

Tip: Why not take a close look at *your* crawler maintenance costs . . . then look at Tournatractor. Ask us for full details.

B & B's rubber-tired fleet strips 8,000 yds. a day

One of B & B's recent contracts involved stripping overburden at M & M Clays, Inc.'s kaolin pit at McIntyre, Ga. From top surface to kaolin, the 36' deep overburden included layers of clay-and-sand, pure sand, water-and-sand, and — just above the kaolin — a 3' layer of sticky gumbo. L-W Tournapulls, with Tournatractors pushing, kept production steady throughout the wide range of materials . . . clicked off 2290' cycles in an average of just 3.9 minutes.

C Tournapulls, with 18-yd. Fullpak* scrapers, pushed by husky Tournatractors, loaded in a hurry. Average load time was only 48 seconds; distance was 90'; and payloads averaged 11 to 12 yards of the heavy materials. When B & B used its full fleet of 4 C 'Pulls* and 2 Tournatractors, daily production averaged a big 8,000 cu. yds.

*Trademark CTCP-1573-MQJ-1

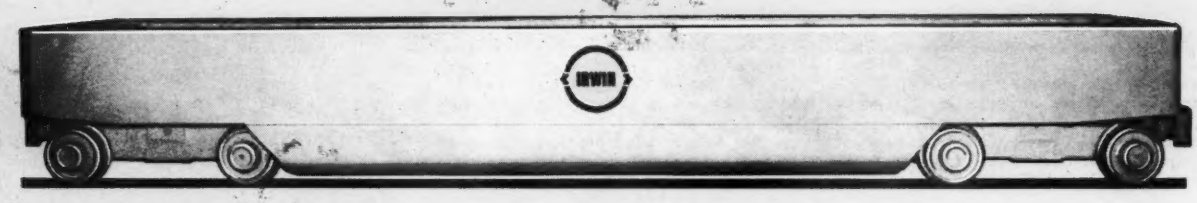
LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

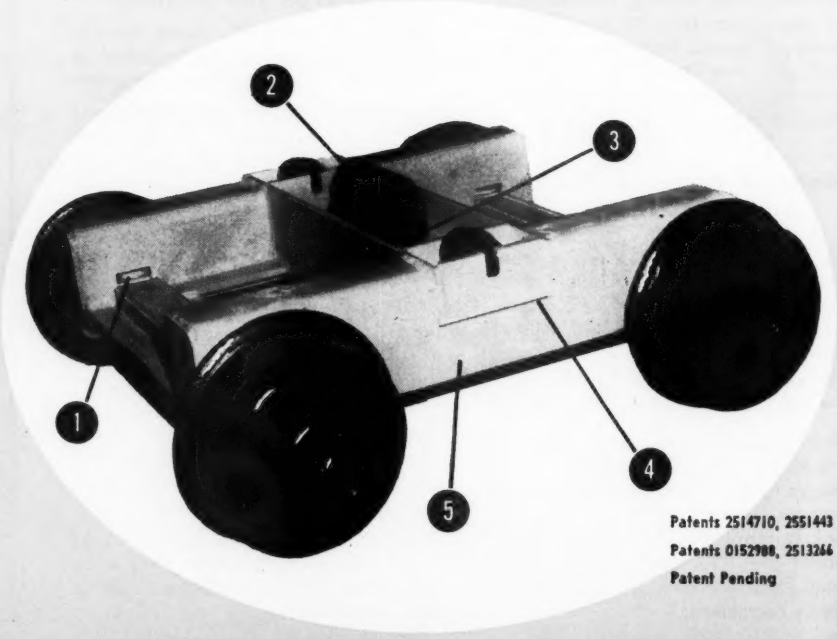
Since 1904 IRWIN

MINE CARS AND EQUIPMENT



Also: THIS NEW, ALL-WELDED MINE CAR TRUCK

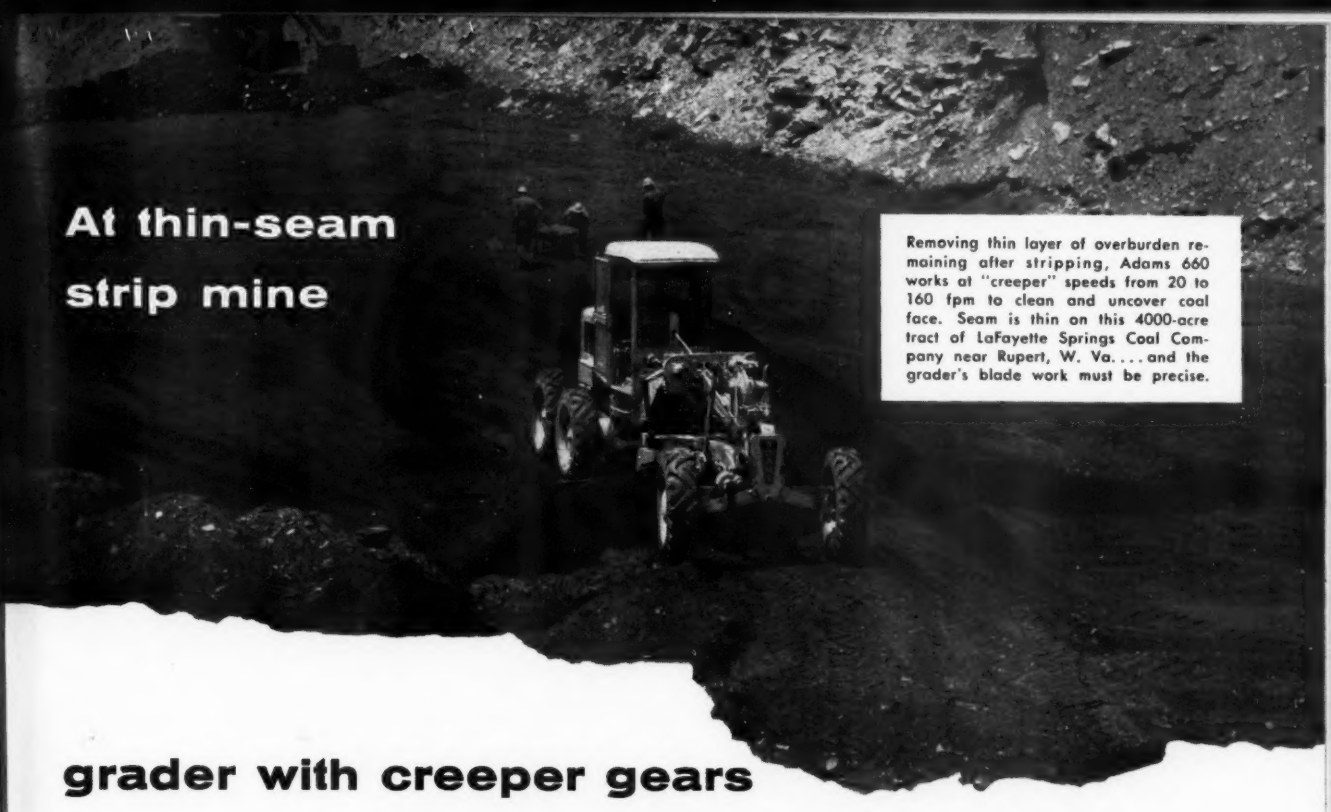
1. Knee action trucks featuring double springs at each wheel giving smoother performance.
2. Irwin patented king-pin assembly allows flexibility in all directions; eliminates binding and over-stressing of structural members.
3. Irwin's special self-lubricated bronze bearings give carefree service (external greasing system for those who desire it for added protection).
4. Irwin rigid box frame construction gives better truck roadability; reduces flange wear to a minimum.
5. Every Irwin truck is custom engineered for the load it will carry and operating conditions; can be supplied in any track gauge or wheel base.



Patents 2514710, 2551443
Patents 0152988, 2513266
Patent Pending

IRWIN FOUNDRY & MINE CAR COMPANY

Phone: UNderhill 3-5000 IRWIN, PA. BOX 311



At thin-seam strip mine

Removing thin layer of overburden remaining after stripping, Adams 660 works at "creeper" speeds from 20 to 160 fpm to clean and uncover coal face. Seam is thin on this 4000-acre tract of LaFayette Springs Coal Company near Rupert, W. Va. . . . and the grader's blade work must be precise.

grader with creeper gears insures profitable coal recovery

Near Rupert, W. Va., the LaFayette Springs Coal Co. of Lewisburg is strip-mining coal from a slate-laced vein 38" thick, which lies under 50' to 75' of overburden. To work this thin seam at a profit requires the use of precision machinery in the recovery process.

LaFayette strips the bulk of the overburden with a large dragline. A thin layer of overburden is left covering the seam. This final covering is carefully bladed off by an Adams* 150 hp 660 motor grader, using powerful, low-speed creeper gears (optional equipment on Adams graders). Operating with full power in 1st gear, at speeds of only 20 to 160 feet per minute, the operator smoothly readjusts the 12' blade of the "660" to match the seam's frequent surface irregularities.

The result is a clean, efficient job of exposing the face of the coal seam. Then—after removal of scattered, vertical slate traces by hand — the clean coal is ready for loading out.

"handles our exacting work"

"I like the way the '660' is built," said Warren Ervin, superintendent. "I like the quick way it performs, its accuracy . . . and the way it handles our exacting work throughout the day."

Operator W. H. Judy agreed. "It's a fine machine," he stated. "It performs better than any I've ever run — and I've run a lot of them in 35 years. This '660's' really got power."

Completes 33% more roadwork

When not doing precision blade work on overburden, the firm's LeTourneau-Westinghouse Adams grader patrols haul roads around LaFayette's 4000-acre area. Operator Judy says the "660's" combination of 150 hp diesel power, 0.23 to 26 mph speed, and accuracy of blade control, speeds all road maintenance.

Choose from 6 work-matched models

Why not find out, in detail, how a powerful, ruggedly-built Adams grader can increase the efficiency of your mine or pit operations? There are six models available, from the 60 hp "220" to the 190 hp POWER-*Flow** 660 with torque converter. Describe your operation, and we will furnish details on the Adams that fits your needs.

Busy haul roads are smoothed regularly by Adams 660. The "660" handles 33% more road maintenance in the same time than a grader previously used.

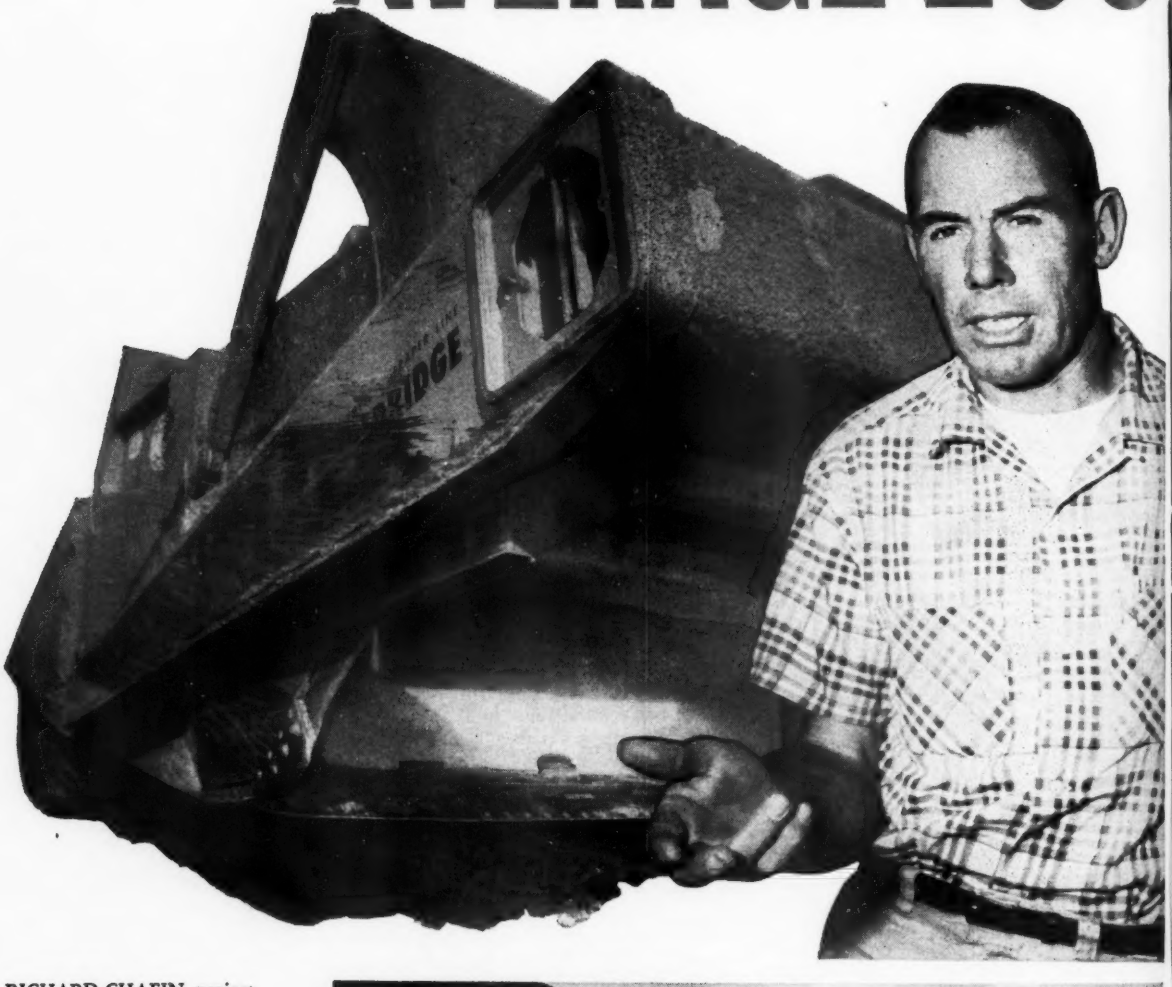
*Trademark G-1765-MJ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

ESCO CUTTING EDGES AVERAGE 200



RICHARD CHAFIN, project engineer of Madonna Construction Company, uses ESCO cutting edges to keep maintenance costs low.

HOURS OF SERVICE
...on each side!

The Madonna Construction Company switched to *ESCO* cutting edges after on-the-job tests that "represented every known strata in southern California." Richard Chafin, project engineer, relied on *ESCO* bits to move 200,000 yards of sandy gravel, studded with 36-inch donickers... and in doing so compiled maintenance figures that showed *ESCO* bits averaging 200 hours before reversing.

Cutting edge longevity is only half the story. Bits that last longer mean less down time, lower charges against machinery idled through frequent bit changes. *ESCO* cutting edges, Chafin found, maintained the 150 cubic yard-per-hour rate that he considers essential if earth moving is to pay.

What *ESCO* products did for this project engineer, they can do for you. Put *ESCO's* durability to work for you. Use *ESCO* cutting edges —they'll save you time, when time is money.

See your nearest ESCO dealer or write direct.

ESCO®

ELECTRIC STEEL FOUNDRY COMPANY
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MFG. PLANTS AT PORTLAND, ORE. AND DANVILLE, ILL.
Offices in Most Principal Cities
ESCO INTERNATIONAL, NEW YORK, N. Y.
IN CANADA ESCO LIMITED

Drill more footage per dollar with Carboloy® carbide inserts in your percussive rock bits!

$250,000 Quality Control Laboratory guards the toughness and wear resistance of every batch of Carboloy carbide

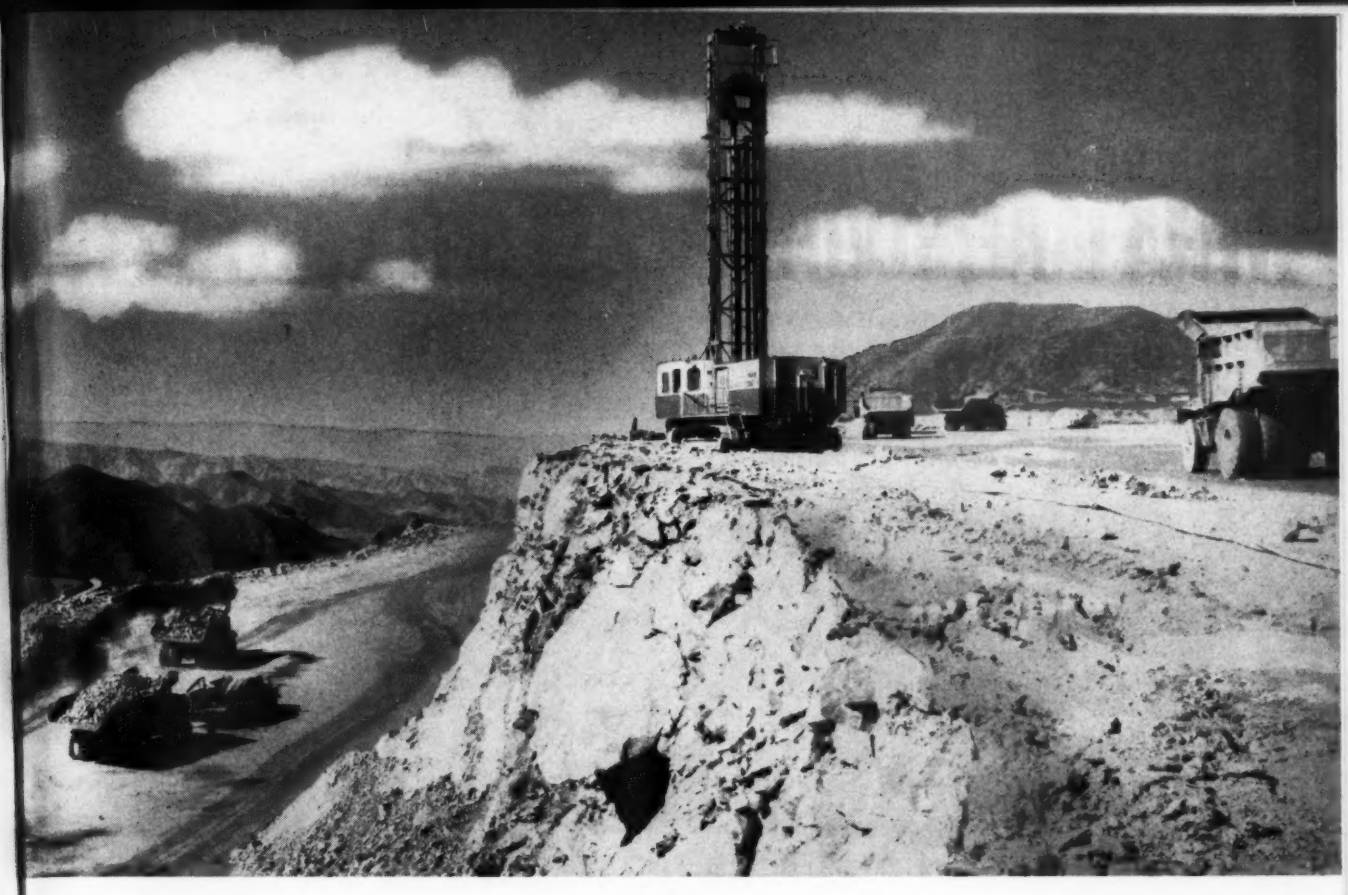
Carbide is used for hard-rock drilling because of its inherent high resistance to wear and breakage. But no carbide can fully measure up to this potential unless it's metallurgically consistent . . . free from even the slightest impurities and defects.

That's why every step in the manufacture of Carboloy carbides is checked and analyzed in the $250,000 Carboloy Quality Control Laboratory. These metallurgically perfect carbides really pay off . . . in longer bit life, faster drilling, more footage per dollar – even in toughest rock formations.

Next time you order percussive bits from your supplier, make sure they've got Carboloy carbide inserts. For more information, write: *Metallurgical Products Department of General Electric Company, 11169 E. 8 Mile Street, Detroit 32, Michigan.*

$20,000 X-Ray Fluorescence unit analyzes composition of Carboloy carbides. It's just part of the $250,000 Quality Control Laboratory that assures consistent performance from Carboloy cemented carbides.

CARBOLOY®
CEMENTED CARBIDES
GENERAL ELECTRIC



50-Rs Speed Mountain Top Removal At Huge Latin American Copper Mine

Fast-drilling Bucyrus-Erie rotary drills were put to use recently as Southern Peru Copper Corporation began blasting operations at its new mine located 100 miles inland from the Pacific port town of Ilo.

Before any ore can be mined, the company must remove the top from a mountain called Toquepala. Excavation amounts to some 120 million tons of rock and earth.

To get things going, seven 50-Rs were brought in for drilling blast holes. They are well equipped for the job. *Variable drilling speed* and *variable pulldown pressure* provide the resources for speedy drilling at Toquepala.

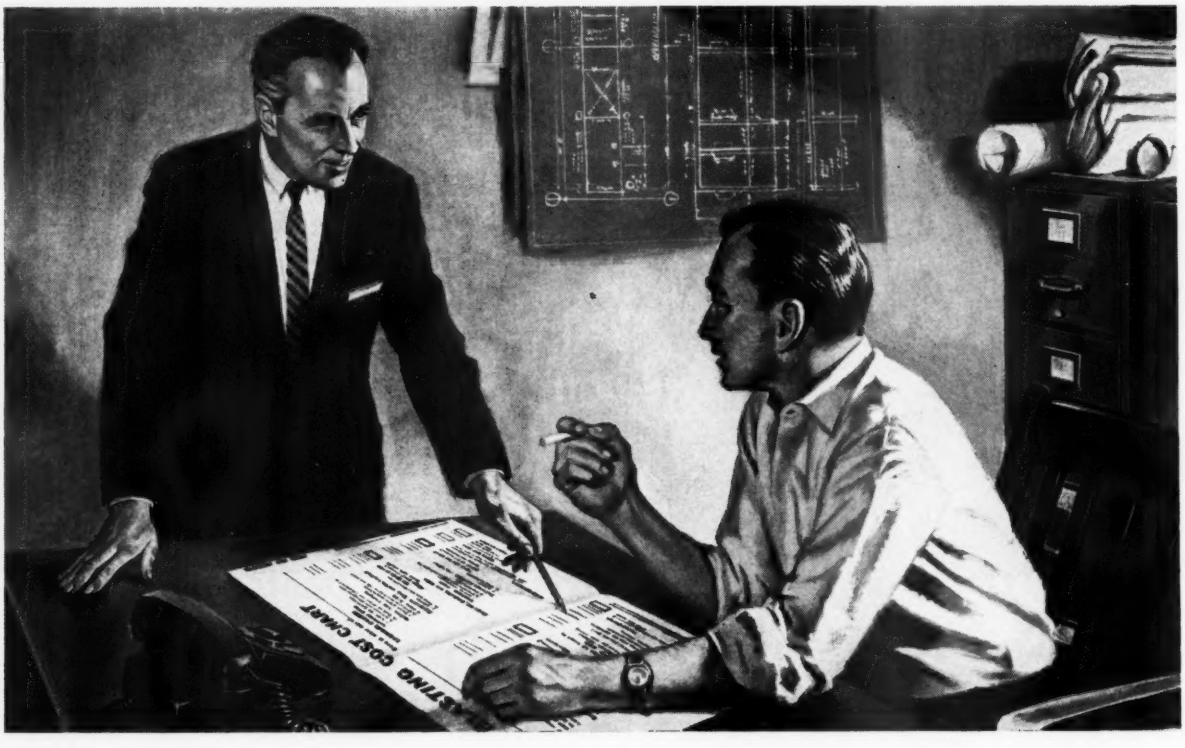
Ward Leonard variable voltage control gives the operator smooth, instant command over rotation of the drill pipe. He can choose the most efficient speed for a given formation without stopping the drilling operation. Hydraulically powered down pressure on the bit provides controlled load on drilling tools for maximum penetration.

These seven 50-Rs are electric rigs designed for drilling 9⅞ to 12¼-in. holes. For drilling 6¾ to 9-in. holes Bucyrus-Erie Company offers the 40-R with either diesel-electric or full electric power.

Get the full story on these drills today. Write direct for illustrated literature. Bucyrus-Erie Company, South Milwaukee, Wisconsin. 74B58C

A Familiar Sign . . . BUCYRUS ERIE *. . . at Scenes of Progress*

TRUE
WHAT ARE YOUR^ BLASTING COSTS?



Get a complete profit picture with new, free Blasting Cost Chart! Let the Atlas Man show you how

Explosives costs alone don't always determine value of a blast. The explosives used have a direct effect on drilling, digging, hauling and crushing costs. Now, a free, simplified computing method—developed by Atlas, gives you a true, complete cost analysis of profits, without involved bookkeeping.

The Atlas Blasting Cost Chart enables you to protect or improve your profits. What's more, it's yours without cost and you can keep your figures confidential. The Atlas representative nearest you will be glad to show you how it works—without obligation.

EXPLOSIVES DIVISION
ATLAS POWDER COMPANY
WILMINGTON 99, DELAWARE *offices in principal cities*

"Not merely to sell; but to serve . . . not only to make good steel products; but to make them still better . . . not only to fulfill today's requirements; but to anticipate tomorrow's—these are the principles that constantly guide CF&I."

G. F. Kranz
President

Grinding Mill Bulletin #1

CF&I is firmly convinced of the value—to us as well as to our customers—of our president's words, quoted above. In line with this principle, we are now commencing a series of ads designed to add important technical facts to the mining industry's store of knowledge on more efficient grinding mill operations. We have purposely restricted the subject matter of these ads so that they will be of interest to only one segment of the readers of this magazine—grinding mill operators. And this is right in line with CF&I's policy—"*not merely to sell; but to serve.*"

Grinding Ball Rationing of the Makeup Charge

A practical means of improving many grinding mill operations is to determine the optimum size assortment of grinding balls that should be added as a makeup charge.

Increased Milling Throughput Reduces Milling Cost

Total milling cost will *decrease* as number of tons processed (throughput) *increases*. This advantage can be realized in any plant, provided that the rate of mining and all steps in ore processing can be increased to match the greater throughput of the ball mill, which makeup charge rationing makes possible.

Indications That Rationed Charge Is Needed

When a one-size ball addition to a mill is being established, the following conditions may indicate that ball rationing is warranted:

1) There may be a certain amount of tramp oversize that can be reduced by replacing a portion of the balls by a larger size.
2) There may be a crowding of particles of reduced size but not of finished size, showing a deficiency of small-size balls.

When a new mill is started up, time is needed to get the process running smoothly. To add a further problem of determining a makeup ration during this start-up period would be ill-timed.

Ball Wear Pattern

When balls of one size are used for addition, the seasoned charge in the mill ranges from balls of the original diameter to those small enough to purge from the mill. If a screen analysis of the ball charge is made using screens with openings of equal increments, such as ½ inch, the weight of the balls on each screen will show a certain pattern or distribution of the charge by weight. Apparently the rate of wear of different ball sizes in the charge is affected by the size structure of the mill feed and by the crystal size of the minerals. Also, the physical and metallurgical characteristics of the ball may vary with the distance from its center.

There is evidence that there is a difference in the wear pattern of grinding balls of different manufacture. Some appear to be *self-rationing* while others do not. This self-rationing quality, the built-in ability to wear evenly and give longest possible service life, is an important feature of CF&I Forged Steel Grinding Balls. Proper analysis steel, and continuous control and inspection at every stage of production help CF&I to impart this self-rationing uality to its grinding balls.

Impact, Nipping and Attrition Grinding

Large balls in the charge drop with greater impact and also have a more effective nipping action on the larger particles. Small balls make a greater number of contacts (since there are more of them), so that attrition grinding is more effective. Fine crushing is increased due to greater nipping action incidence on the small particles. Ball rationing is employed to change the size distribution of the ball charge to one that has a better ratio of impact, nipping and attrition.

Not All Mills Should Attempt Ball Rationing

Most small mills, and some of the larger ones, do not have the facilities to blend mine run ore for mill feed. With a great variation in character of feed, establishing even an optimum single-size ball charge may be a difficult problem. Facilities, personnel, and sufficient time may not be available for careful testing. The cost of such an effort may not be justified. Total savings in dollars and cents, through a relatively minor improvement in grinding practice, will not be as great in a small operation as in a larger one. Nevertheless, it appears obvious that, for many operations, the attaining of an ideal ball ration can increase the efficiency of milling sufficiently to warrant the effort involved in its development. Other pertinent factors will be discussed later in this series.

For a reprint of the article on which this ad is based, please write on your company letterhead to: Mining Supply Department, The Colorado Fuel and Iron Corporation, P. O. Box 1920, Denver, Colorado.

OTHER CF&I STEEL PRODUCTS FOR THE MINING INDUSTRY

CF&I Grinding Rods · CF&I Grader Blades · CF&I Industrial Screens
CF&I Mine Rail and Accessories · Wickwire Rope · CF&I Rock Bolts

FORGED STEEL GRINDING BALLS
THE COLORADO FUEL AND IRON CORPORATION
5822

Albuquerque · Amarillo · Atlanta · Billings · Boise · Boston · Buffalo · Butte · Chicago · Denver · Detroit · El Paso · Ft. Worth · Houston
Kansas City · Lincoln (Neb.) · Los Angeles · New Orleans · New York · Oakland · Oklahoma City · Philadelphia · Phoenix · Portland
Pueblo · Salt Lake City · San Francisco · San Leandro · Seattle · Spokane · Wichita

TWO BITS
for cutting your costs...

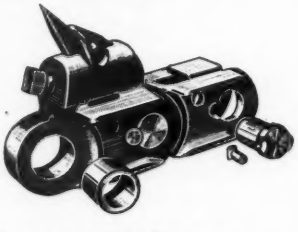
Average cost of either style is only

(that's less than 3¢ per point)

1. With this patented CONCAVE shape, side clearance is automatically maintained as the face wears away. This means uniform power consumption over the full life of the bit.

2. The HEAVY DIAMOND has a similar "stay-sharp" design feature, produces coarse cuttings. A rugged bit for severe conditions such as Iron Pyrites or Rock.

ALL MINING MEN KNOW . . .
IT'S NO TRICK TO TURN OR REPLACE WORN BITS IN BOWDIL'S "QUICK-CHANGE" HOLDERS . . .



Any Bowdil Sales Engineer can help you establish the best style and temper for your need . . . and show you why

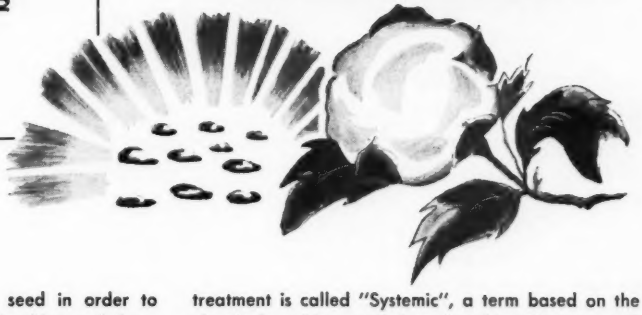
"THE LONGEST ~~DISTANCE~~ CUTTING BETWEEN TWO POINTS IS A BOWDIL BIT"

The BOWDIL Company
CANTON, OHIO

SULPHUR *helps to create* **HEADLINE** *products*

Thimet®

'built in' protection that immunizes the cotton plant by treating the seed



A revolutionary idea . . . this treatment of the seed in order to protect the young plants against the onslaught of sucking and chewing insects that are prone to attack young plants. The immunization lasts up to seven weeks, or long enough for the plant to get a good strong start without the need of spraying or dusting. This particular treatment is called "Systemic", a term based on the fact that the chemical used is actually introduced into the system of the plant. The seed, coated with the insecticide, is planted and as the plant grows, the protective chemical is drawn up from the seed into the sap stream, flowing to all parts of the plant.

This unique compound is called THIMET which has the following empirical formula:

$C_7H_{17}O_2PS_3$

Note the presence of Sulphur. THIMET is one of the latest in a long line of useful agricultural formulations which either end up with Sulphur in the product itself or require Sulphur or a derivative in the processing. Because of its revolutionary impact actually upon the cotton growing industry and potentially upon other agricultural activities, THIMET can rightly be called a 'headline product'.

®*THIMET is a tradename of American Cyanamid Company.*

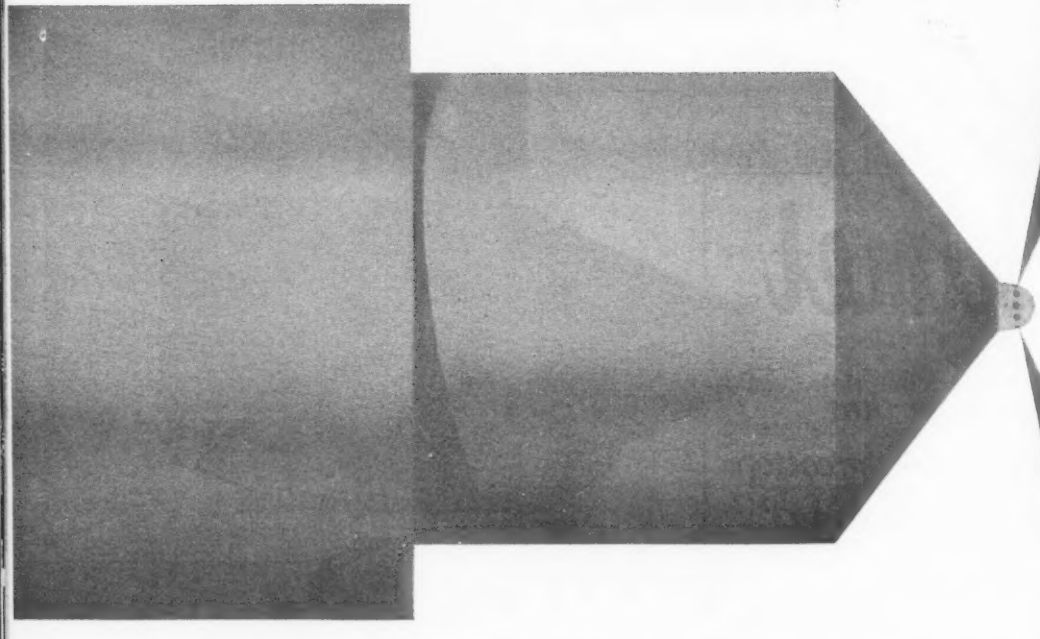
Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.
811 Rusk Avenue, Houston 2, Texas

Sulphur Producing Units
- Newgulf, Texas
- Moss Bluff, Texas
- Spindletop, Texas
- Worland, Wyoming

How STANDARD DIESEL FUELS

can help you cut coal hauler engine maintenance



You get three big benefits with STANDARD Diesel Fuels. They mean less engine maintenance, extended time between overhauls, more in-service operation per hauler—*and more profit on each ton of coal.*

1. STA-CLEAN*—a Standard Oil exclusive. This additive in STANDARD Diesel Fuels insures clean burning of the fuel, prevents fuel-injector sticking, minimizes rusting of fuel tank, fuel line and engine parts.
2. Clean fuel. Standard Oil exercises special care in handling your diesel fuel to make sure it is delivered to you *clean.* Contamination is eliminated. There's no foreign matter in the fuel to cause engine failure or maintenance problems.
3. Balanced distillation means you get good, economical engine performance. Cleaner engines mean better performance and longer periods in service between overhauls.

Check in with your Standard Oil industrial lubrication specialist for more facts about STANDARD Diesel Fuels. There's one of these specialists near you in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

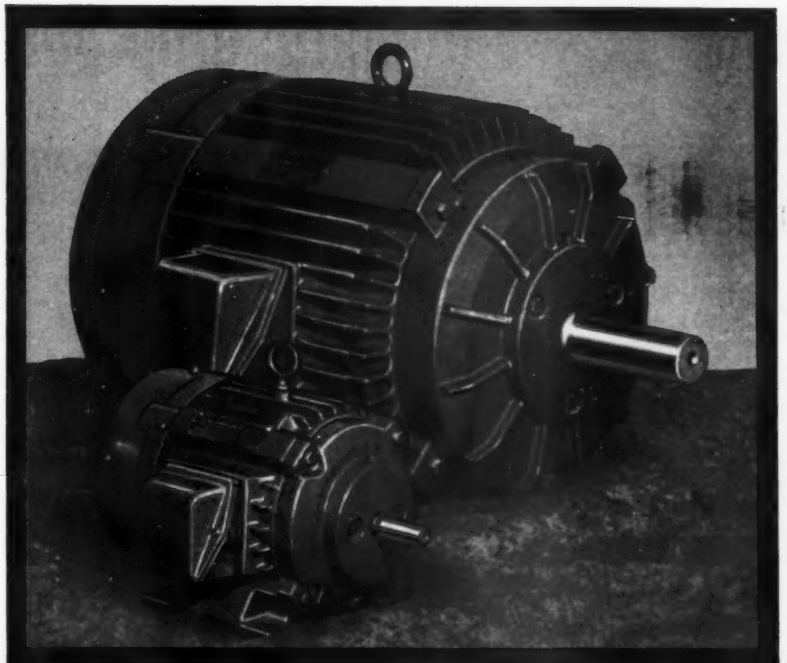
TANDARD OIL COMPANY
(Indiana)

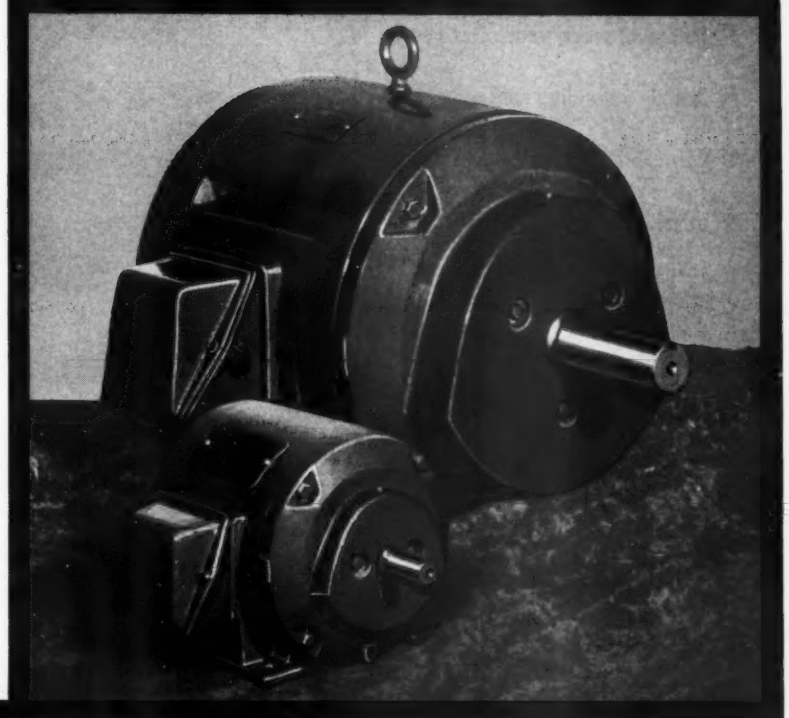
STANDARD

*Trade Mark

RELIANCE

extends Totally Protected A-c. Motor line to 125 HP.





Reliance's proven Totally Protected design is now being extended thru 125 horsepower.

Now Totally Protected Motors will be available to you from 1 thru 125 hp. in new NEMA ratings.

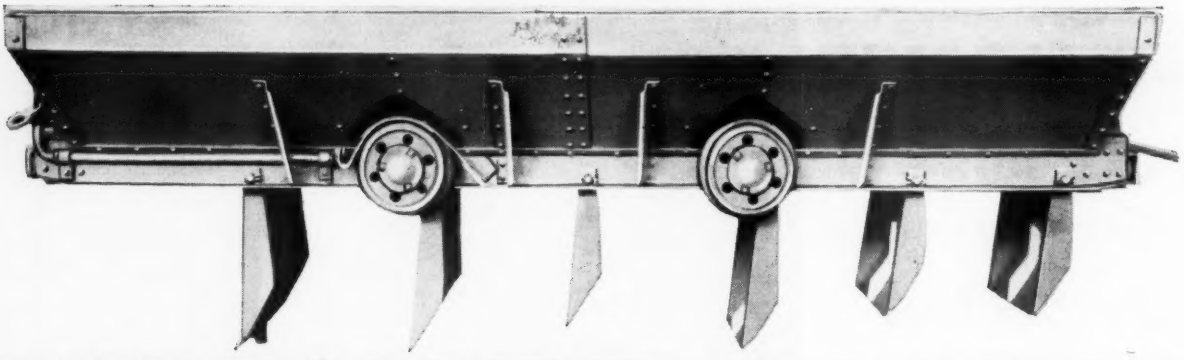
Immediate delivery from stock today, 1 to 50 hp. Contact your Reliance representative for shipping schedules on other ratings. B-1673

Write or call today for further information

RELIANCE ELECTRIC AND ENGINEERING CO.

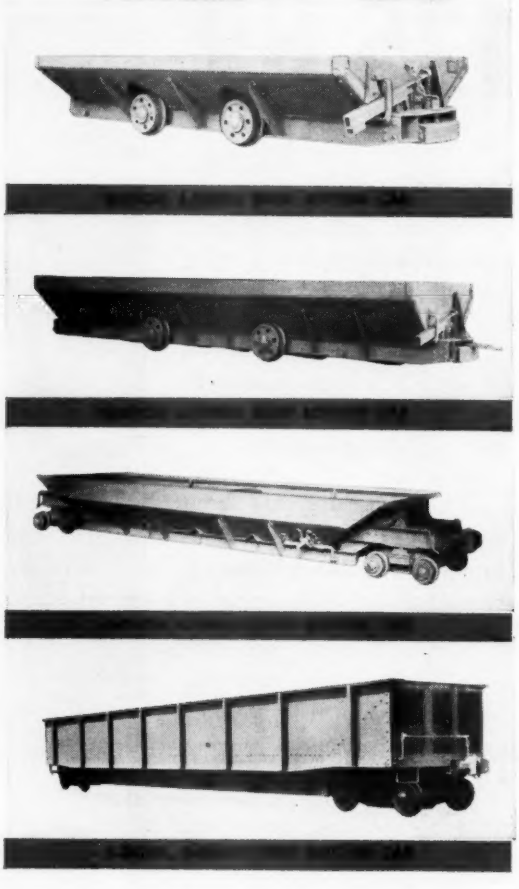
DEPT. 94A, CLEVELAND 17, OHIO
CANADIAN DIVISION: WELLAND, ONTARIO
Sales Offices and Distributors
in Principal Cities

only acf automatic drop bottom cars have



LUBRICATED DOORS!

- **Smoother, faster operation**
- **Minimum wear, year after year**
- **Speedy unloading with easy, positive door action**
- **Corrosion resistant hinge rods**
- **Interior fittings for greasing**



acf Automatic Drop Bottom Mine Cars are available in every capacity and type. Designed and constructed to meet specific operating needs. Welded end sill members, exclusive double action spring bumpers. Chilled Tread "Load Support" Wheels with roller bearings assure long, trouble-free service.

For complete information, contact your nearest acf sales office.

American Car and Foundry, Division of acf Industries, Incorporated, 30 Church Street, New York 8, New York.

Sales Offices: New York—Chicago—Cleveland—Washington, D.C.—Philadelphia—San Francisco—St. Louis—Berwick, Pa.—Huntington, W. Va.

Bulletin describing all types of acf Mine Cars *available on request.*

acf

AMERICAN CAR AND FOUNDRY

DIVISION OF ACF INDUSTRIES, INCORPORATED

MINE CARS FOR CONSTANT HAULAGE.

inside story of a longer grind

Moly-Cop is hard and tough to the core...

A look inside this Moly-Cop ball shows a uniform, fine grain structure extending to the core. It is the result of special alloying, forging and heat treating that provides a hardness and toughness best suited to grinding needs. This is why you can expect a long, economical grind from Moly-Cop balls. It's the big reason why *Moly-Cop* balls have become the *STANDARD OF COMPARISON AROUND THE WORLD.*

SHEFFIELD

ARMCO®

MOLY-COP

TRADE MARK

COPPER-MOLYBDENUM-ALLOY

Grinding Balls

SHEFFIELD DIVISION

ARMCO STEEL CORPORATION

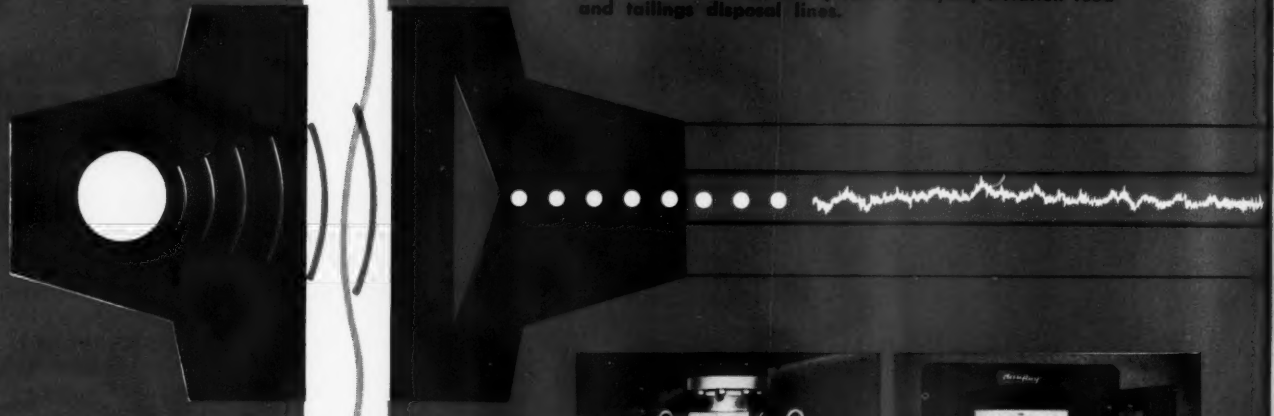
SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA

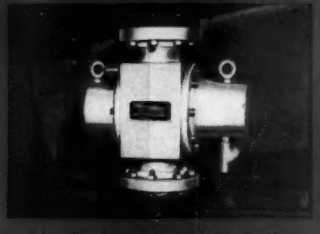
EXPORT REPRESENTATIVES, THE ARMCO INTERNATIONAL CORPORATION, MIDDLETOWN, OHIO

AccuRay® offers continuous flow density systems

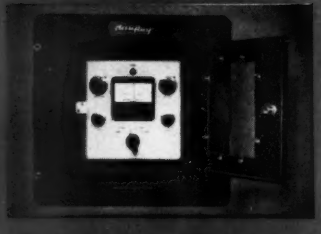
Accurately measuring liquid density, specific gravity, percent solids or related quantity, the AccuRay Density System applies nuclear radiation measurement to process control. Without contacting the process material, measurement is made continuously, independent of flow rate, pressure or viscosity. The AccuRay System is stable and rugged—designed to withstand shock and vibration under the most adverse industrial conditions.

Measurement of slurry density in the mining and ore dressing industries is easily accomplished. No plates, taps, purges or floats are used in the integral pipe section. Fouling cannot occur, and pipe erosion will not effect accuracy or safety of operation. To maximize throughput yield and profit, the system will continuously measure solids content in filter feed, jig circuits, cyclone output, thickener underflow, heavy media recycle, flotation feed and tailings disposal lines.





AccuRay Measuring Head Is Easily Installed In Pipe System—Flange Connections.



The AccuRay Density Instrument visually indicates variations in fluid density —may be located remotely from measuring head.

® AccuRay is a Registered Trademark of Industrial Nucleonics Corporation

Industrial Nucleonics
CORPORATION
1165 Chesapeake Ave. Columbus 12, Ohio

Please send complete details on AccuRay Continuous Flow Density Systems

Name ..... Title .....

Company .....

Street .....

City ..... Zone ..... State .....

Application .....

.....

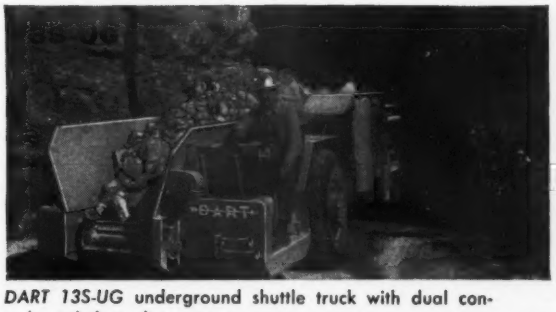
357

The World's Largest Manufacturer of Nucleonic Industrial Process Control Systems

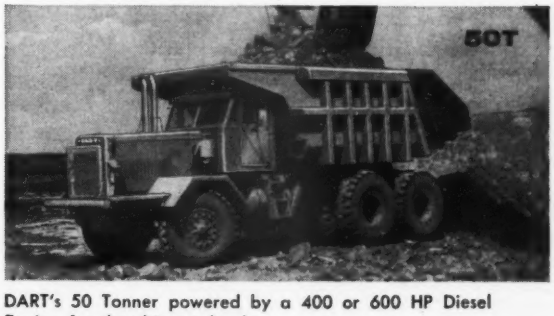
The DART 35SL, hauling 35 Tons Payload. Proven lower cost per ton. Lower load-weight ratio. Just ONE engine, transmission, rear axle!

PROFITABLE PAYLOADS WITH Dart TRUCKS

DART TRUCK COMPANY builds a complete line of trucks—from 10 to 50 Ton payloads. *But,* any model can be built to meet your special haulage requirements.



DART 13S-UG underground shuttle truck with dual controls and through conveyor.



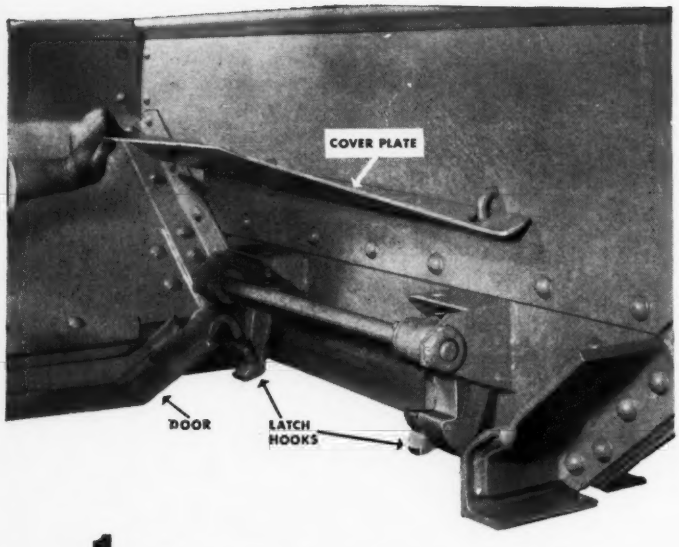
DART's 50 Tonner powered by a 400 or 600 HP Diesel Engine for that big payload.

WRITE FOR SPECIFICATIONS TODAY

DART TRUCKS
TONNAGE ENGINEERED
Kansas City 8, Missouri

D-140

Bulletin! March 14 Dart merged with Kenworth Motor Truck Division of Pacific Car & Foundry Co. New name! KW-Dart Truck Co.



Only S-D Automatics give you these advantages

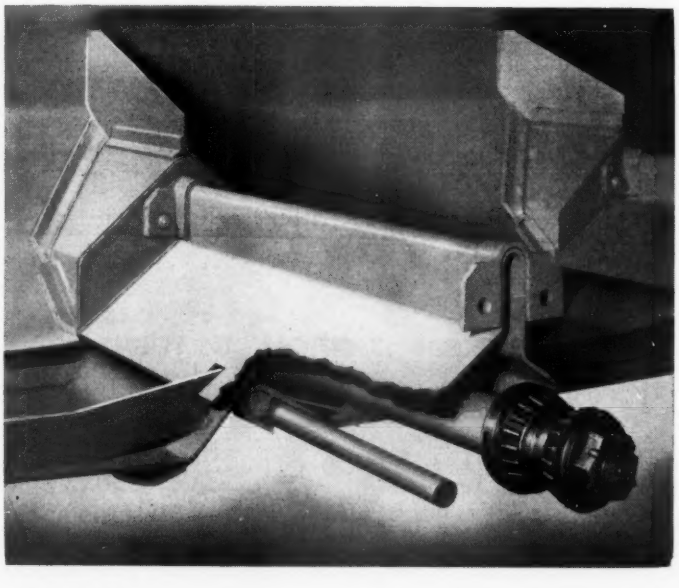
1 TWO LATCHES FOR SAFE AND SURE LATCHING! They are tripped simultaneously underneath car for automatic dumping. With S-D "Twin Safety Latches" your bottom dumping car doors are actually padlocked twice. These latches (see photo above) are tripped independently by a pair of tripping devices mounted between the rails. (Note the tripping devices shown in bin photo on opposite page.) Both latches must be tripped simultaneously before the doors open. This eliminates doors opening accidentally anywhere along the haulage route.

1 "Twin Safety Latches" for safe and sure latching

2 Safety Sealed against dust leakage

3 ¼ to ½ ton more capacity per car for the same overall dimensions

2 SEALED AGAINST DUST LEAKAGE! Sanford-Day's exclusive bottom dumping car seal means two extra values: (1) Sealed S-D Automatics give you a new, safer in-the-mine operation by eliminating leakage of dust. (2) Sealed S-D Automatics enable you to make a tremendous reduction in track clean-up costs. Cross-sectional view at right points out how the flares extend over doors when closed, sealing material in car.



3 ONE-QUARTER TO ½ TON MORE CAPACITY PER CAR FOR THE SAME OVERALL DIMENSIONS is available only in S-D Automatics because of the construction features of Sanford-Day's exclusive bottom dumping car design. If you were buying, for example, 16 bottom dumping cars of any other make with a 4-ton level full capacity, you would need only 14 S-D Automatics of the same overall dimensions to haul the same tonnage. You would save two cars in every 16 . . . 12½ percent in original investment . . . 12½ percent in maintenance . . . 12½ percent less dead weight to haul. Any one of our sales engineers will demonstrate to your complete satisfaction just how we are able to give you this extra capacity.

THESE THREE fundamental and necessary advantages are offered only by S-D Automatics! They mean that only S-D Automatics can haul coal out of your mine at the lowest possible cost! Assure yourself of the maximum economies bottom dumping cars offer you by buying S-D Automatics! For complete information, write or call us today. Sanford-Day Iron Works, Inc., P. O. Box 1511 . . . Telephone 3-4191, Knoxville, Tenn.

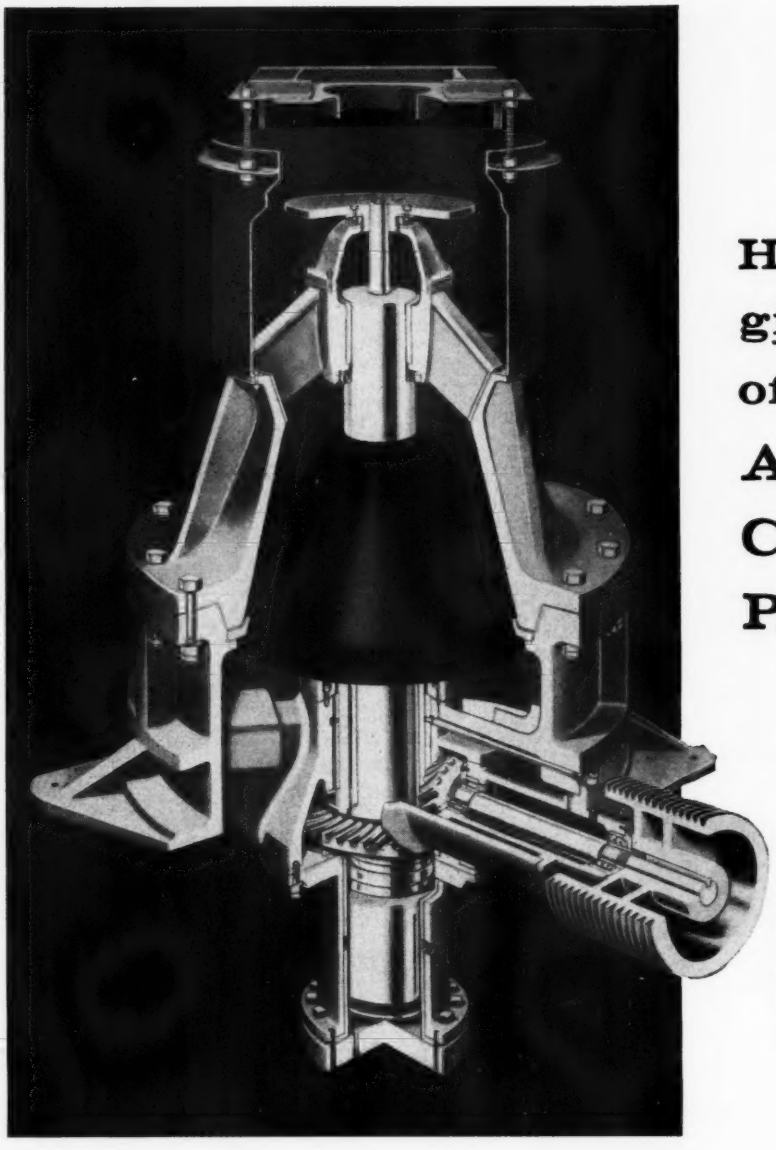
Sanford-Day IRON WORKS

KNOXVILLE • TENNESSEE

MINE CARS, All Types - PRECISION WHEELS - "Brownie" HOISTS CAR RETARDERS - SPOTTERS PUMPS - OIL SPRAY SYSTEMS

AND

BROWN-FAYRO DIVISION



How a little give adds a lot of life to... AMSCO CRUSHER PARTS

Concave ring and mantle of this *Hydrocone* crusher are made of the toughest steel known . . . Amsco Manganese Steel. It *gives* a little, to take more punishment. *Hydrocone* is a registered trade-mark of the Allis-Chalmers Manufacturing Company.

Both mantle and concave ring crush a lot more feed because of certain properties of Amsco® Manganese Steel. The metal *gives* a little under crushing forces, absorbs stresses, resists cracking and chipping. Yet these same forces work-harden the surface of Amsco Manganese Steel to as much as 500 Brinell . . . a high hardness, stubborn to wear.

Amsco Manganese Steel Crusher Parts maintain their ductile undersurface and work-hardened surface even when worn thin. That's why Amsco parts endure severe abuse for so many work hours without letup.

To be sure of getting Amsco Manganese Steel, order replacement parts from your crusher manufacturer. Amsco makes manganese steel parts for most manufacturers of crushing, grinding and pulverizing equipment.

Amsco also produces other alloy steels with maximum wear resistance under particular service conditions

AMERICAN Brake Shoe COMPANY

AMSCO

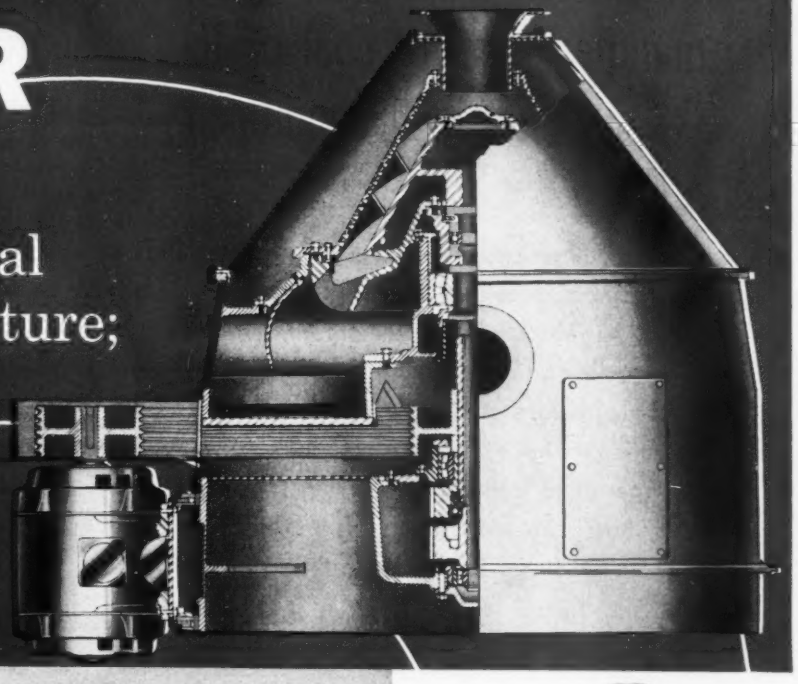
American Manganese Steel Division • Chicago Heights, Ill.

OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DEL., OAKLAND, CAL., ST. LOUIS, JOLIETTE, QUEBEC

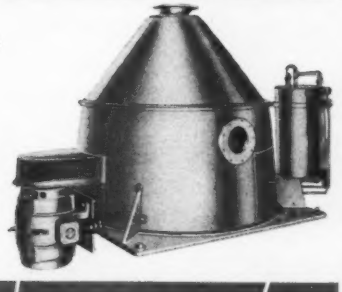
CMI

CONTINUOUS CENTRIFUGAL DRYER

designed to dewater coal to 5% moisture; high rated capacity



Accepted as standard equipment by most of the country's leading mines. Lowest power consumption...lowest maintenance cost...lowest "per ton" cost. Periodic inspections furnished and emergency service available from strategic locations.



Brochure No. [illegible] giving complete details available upon request.

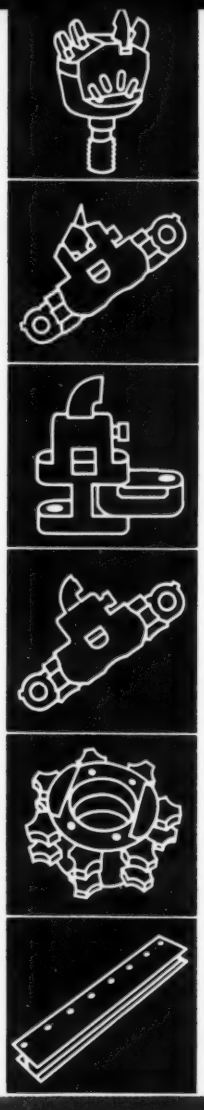
CMI CENTRIFUGAL AND MECHANICAL INDUSTRIES INCORPORATED

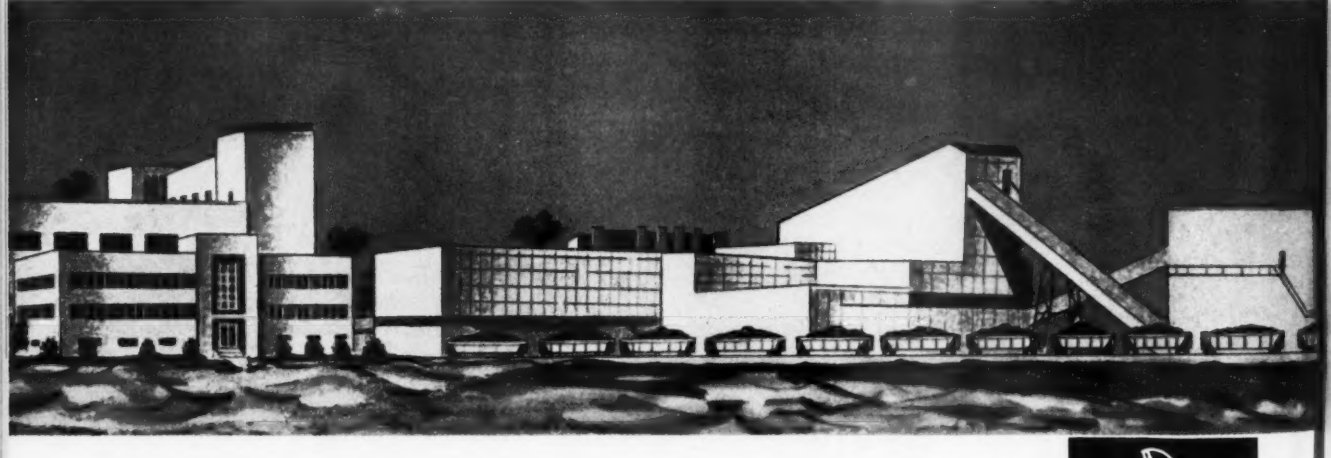
146 President Street • Saint Louis 18, Missouri

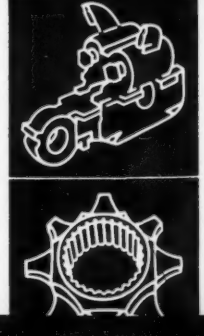
Cincinnati...

specialists for over 34 years... manufacturers of coal cutting equipment to meet all conditions

Years of experience, plus a highly trained staff of engineers, researchers, metallurgists and production experts have enabled CINCINNATI MINE to provide more efficient chains, bits and cutter bars for your particular cutting problem. As a pioneer and leader in the manufacture of cutting equipment, we appreciate the close cooperation we have had from mine operators everywhere. Through this cooperation, testing and working together, we feel the entire industry has benefited. Pioneers from the beginning, CINCINNATI ***looks*** forward to **go** forward with the entire industry.







THE CINCINNATI MINE MACHINERY CO.

2980 SPRING GROVE AVENUE • CINCINNATI 25, OHIO

Exclusive P&H MAGNETORQUE® and ELECTRONIC CONTROLS put this 8 yd. P&H 1800 Electric Excavator far out in front for daily output in open pit mining operations.

This 2½ yd. P&H 955A is stripping overburden near Clarksburg, West Virginia. It is equipped with *exclusive* P&H MAGNETORQUE® *Electric Swing* which provides smoother, faster swings—without friction—without wear.

P&H Independent Planetary Boom Hoist contributes to the efficient operation of this 20-ton P&H 255A-TC. Boom lowering is always done under power in handling materials at this mine siding in McDowell County, West Virginia.

P&H

serves these open-pit mining needs

stripping

digging

loading

in a wide range of capacities

THE P&H LINE:

Electric Excavators from 3½ through 10 cu. yd.
Power Excavators from ½ through 4 cu. yd.
Truck Cranes from 10 through 70 ton capacity

HARNISCHFEGER
Construction and Mining Division
Milwaukee 46, Wisconsin

Yieldable Arch can be installed as the drift is being driven

These workmen illustrate another special advantage of Bethlehem's yieldable mine roof support: they're installing Yieldable Arch sets right next to the breast of the drift. That means the overburden is brought under immediate permanent control, without the time and expense of temporary roof support.

And we do mean *control*, for as soon as the surrounding forces bear down too hard, the Yieldable Arch will give a little instead of collapsing. This allows the overburden to settle gradually until it forms a natural pressure arch around the mine opening.

The Yieldable Arch works on a sliding joint principle, with friction the determining factor. Nestable segments of U-shaped rolled steel are overlapped at the ends, and these joints are secured with heavy U-bolt clamps which are drawn up tightly enough to hold fast under normal loads. Excessive pressure, however, overcomes the friction in the joint, causing the arch to yield. The load is thus relieved and the structural integrity of the arch is maintained.

Horizontal braces or struts tie one arch set to the succeeding one to provide lateral stability to the structure. Blocking and packing between the lagging and roof are recommended to distribute loads evenly.

Bethlehem engineers have acquired considerable experience in the use, installation and maintenance of Yieldable Arches, and would be glad to apply their experience to your mine-roof problems. A visit to your workings would, of course, be helpful and we would welcome the opportunity whenever it is convenient for you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
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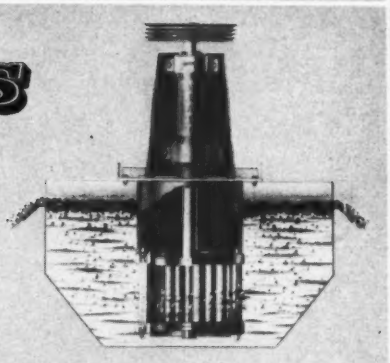

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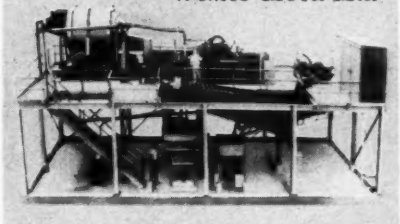

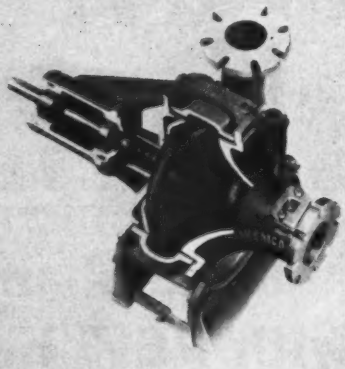

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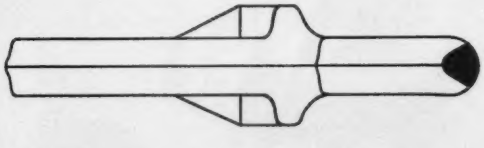

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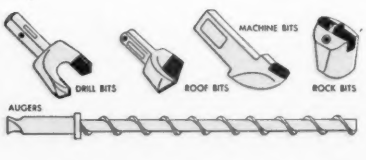


EDITORIALS

ROBERT W. VAN EVERA, Editor

APRIL, 1958

EDITOR'S NOTE: The following report on a recent ILO Conference at Geneva deals with a matter of such vital importance, not only to the mining industry but to our country, that we take pleasure in presenting it as a Guest Editorial. Messrs. Kellar and Kitchel were nominated as employer delegates to the Conference by the Board of Directors of the American Mining Congress.

THE ILO CONFERENCE ON MINING

A Report by Kenneth C. Kellar and Denison Kitchel

HAVING attended an International Labor Organization conference at Geneva, Switzerland, we are convinced that Alice's Adventures in Wonderland were dull in comparison. We are also convinced that continued participation in the ILO by the United States is not in the best national interest.

The conference to which we were accredited as United States employer delegates was officially entitled the "Tripartite Technical Meeting on Mines Other Than Coal Mines." Convened by the Governing Body of the ILO, the two weeks meeting (November 25-December 7, 1957) was ostensibly called for the purpose of discussing problems of labor-management relations common to the mining industries of the 25 nations which participated. Each delegation consisted of two employer delegates, two worker delegates and two government delegates. Of the Communist nations, Russia and Yugoslavia were represented.

There were four items on the agenda for the meeting:

1. Social problems arising in mines other than coal mines.
2. Accident prevention in mines other than coal mines.
3. Machinery for wage fixing and wage protection in mines other than coal mines.
4. Industrial relations in mines other than coal mines.

In advance of the meeting, the permanent staff of the ILO had prepared "reports" on each of these items and sent them to the prospective delegates.

The first item, social problems, obviously opened the door to every conceivable and irrelevant topic from childbirth to cemetery accommodations. These social problems were "discussed" by means of prepared speeches delivered by almost every delegate to the conference at "plenary sessions" held throughout the two weeks period. Captives of the permanent staff of the ILO, we heard speech after speech condemning employers as a class for their ruthless exploitation of the working man. We heard speech after speech extolling the virtues of governmental regulation and intervention in all phases of labor-management relations. We heard speech after speech describing the wonderful freedoms vouchsafed to the workers in Communist countries. And, of course, we heard speech after speech praising the great work of the ILO.

The other three items on the agenda were referred to subcommittees. In this subcommittee framework lay the possibility that we would actually have the opportunity to exchange ideas and discuss mutual problems with the delegates from other nations. But here, again, under the rigid direction of the ILO permanent staff, discussion was reduced to a minimum and the production of embryonic international legislation quickly became the major activity of the subcommittees. Almost at the very outset and as if from out of the blue, there appeared on the desk of each subcommittee member a complete "draft" of a resolution prescribing in detail the principles, rules and regulations which should govern all phases of the subject matter under "discussion." From then on the "discussion" consisted of voting on these specific proposals, obviously prepared well in advance of the conference by the permanent staff, acting as the handmaiden of the left-wing international trade unions.

The final day of the conference found us unwittingly convened as an international parliament. For seven consecutive hours we were maneuvered through the labyrinths of legislative chicanery to produce the end products conceived by the permanent staff long before we arrived in Geneva. In seven short hours and after two short weeks of "discussion," we resolved most of the grave issues of labor-management relations with which the mining industry has been wrestling for centuries.

We can report that the United States employer delegates to the conference were unique, conspicuous and outspoken in their unwillingness to conform and in their opposition to the socialistic and legislative aspects of the meeting. Taking the position that the conference had not been convened for the purpose of legislating on the internal affairs of their country, their performance might best be described as that of skunks at an international lawn party. We can also report that their independent attitude was the envy of most of the employer delegates from the other free nations, who, because of the ascendancy of labor socialism at home, could not afford to oppose the activities of the ILO no matter how unpalatable they might be.

This is the sinister aspect of this and other ILO conferences. With the exception of the United States and Canada, and possibly Australia, the employers and governments of the world fear the ILO. It is our conclusion that the ILO is the vehicle of the international socialists and the tool of the left-wing international trade unionists.

The United States pays twenty-five percent of the cost of maintaining and operating the International Labor Organization. We question whether such a contribution, or, in fact, any contribution to national suicide, is in the best interests of our country.

As for the "Tripartite Technical Meeting on Mines Other Than Coal Mines," suffice it to say that it was the most interesting, most frustrating, most disturbing, most diabolical and most useless conference we ever attended.

SAFETY ADVANTAGES in The Use of A-C Power Underground

Use of alternating current reduces hazard of mine fires, dust and gas ignition by electric arc, and gas ignition by face equipment. In addition, the ready availability of proper voltage makes area lighting much more attractive

By RALPH M. HUNTER
Manager, Electrical & Mechanical Department
Rochester & Pittsburgh Coal Co.

INTEREST in a-c power for coal mining has increased greatly in the past two or three years, for several good reasons. The size of individual pieces of equipment has increased, and is increasing, creating large blocks of concentrated load. The high productivity of these new machines means that they advance much more rapidly than former equipment, and thus create problems in moving conversion equipment frequently, to maintain economical voltages at the face. At usual d-c voltages, trailing cables become large and difficult to handle. The large currents drawn by the equipment make it extremely difficult to relay the trailing cable circuits so that power will be removed in case of a cable failure. Frequently, the current drawn by an arcing cable is much less than the normal load current.

Capital Cost of A-C Installation—$115/KW

For many years the large investment in d-c conversion and mining equipment made it difficult to economically justify changing to alternating current. With the advent of new mining equipment, requiring additional d-c conversion equipment, this point has become less important. New mines, of course, can take advantage of the lower capital cost of a-c equipment. In many cases it is economically feasible to install a-c machines in mines that are already operating with direct current.

From a capital standpoint, an a-c installation, including protective equipment and relays, will cost about $115 per kw, installed. A d-c conversion unit in the 300 to 500-kw range alone will cost about $125 per kw. If equipment to give protection approximating that supplied by the a-c installation is provided, the installed cost will be about $177 per kw.

Relative Copper Required for A-C, D-C Loads

Figure 1 shows the relative copper required to carry power at 250 volts d-c and at 440 volts a-c. The d-c cable includes no ground wire, depending on an electronic device to guard against grounds in the machine. Protection against cable faults depend on operation of the over current device at the source end of the cable. If a two conductor Type G cable were used instead of the two single conductor cables, the weight of the cable would be 6.8 lb per ft, and the cost would be $7.75 per ft, instead of $4.90. It is questionable if any safer cable operation would be obtained.

The a-c cable, on the other hand, contains ground wires, and the construction of the cable and the location of the ground wires is such that any fault will probably be a line-to-ground fault rather than a line-to-line fault. As will be shown later, a line-to-ground fault in an a-c circuit is relatively easy to protect against. Trailing cable faults are just as common with alternating current as with direct current, since these faults are almost altogether due to the service and not to the power source. However, a cable fault, with alternating current, rarely develops into an open arc. In fact, it has been necessary to develop a device to locate faults in a-c cables, since these faults usually operate the protective devices before the jacket of the cable is ruptured. It is very seldom that any device is required to locate the fault in a d-c trailing cable.

Three Safety Factors

The key to the safety of alternating current is the wye connected transformer. This is not a new development, but in recent years it has been applied in a more practical manner as far as mining is concerned. Figure 2 shows the two most common transformer connections. The delta connection, shown for 440 volts, has a voltage of 440 volts from line to line, and no definite neutral. A voltmeter connected from any line to ground will show a voltage of approximately 255 volts, but this voltage is present due to electrostatic coupling, which in plain language means that it is imaginary, in that it does not involve any power. A ground on any one phase will not cause a fault current to flow. It will make the voltage from either of the other two phases to ground 440 volts. A second ground, on one of the other phases, results in a short circuit, and the current which flows in the fault is limited only by the resistance of the circuit. These two ground faults may be widely separated, physically, and the fault current often takes diverse paths and reaches rather high values. The delta connection is valuable where continuity of service is vital and where equipment and manpower are available to locate and clear the first ground promptly. Since in a mining application it is necessary to remove the power in case of a fault, this connection is seldom used in mining, except in conjunction with grounding transformers, and then the action is the same as for wye connected transformers.

The wye connection also gives 440 volts line to line. However, this connection provides a neutral connection, that is, a point that is consistently at the same voltage, relative to the line. This point can be grounded, and when grounded it assures that the voltage between any line and ground will not exceed 255 volts. Also, with the neutral grounded a line ground results in a flow of current that is limited only by the circuit resistance. This resistance is frequently rather low, and high currents can result. Then too, voltages along the ground path can build up to rather high values. In some cases enough voltage gradient can appear in the earth that a man can be shocked walking over the ground. For this and other reasons, the wye connection is modified by inserting a resistance in the neutral connection. This resistance, when combined with a metallic ground path, prevents high fault currents from ground faults and also assures that most of the fault voltage will appear across the grounding resistor. Because any ground fault current must return to the transformer, a low energy relay in the neutral lead will give prompt and accurate clearing of ground faults. Thus, three factors contribute to the safety of an a-c power installation: the wye connected transformer, the neutral resistor and the ground conductor.

Practical Voltage for Transmission Circuits

Usually 4160 volts is selected for a transmission voltage, because it is the wye voltage for 2300-volt transformers, and because this voltage lies in the range below 5000 volts. A large number of cables, connectors, circuit breakers, and other devices have been developed for use in this range over the years. In the electrical manufacturing field, less than 5000 volts is "industrial" equipment, and over 5000 volts is "power" equipment. Basic components of industrial equipment can often be adapted to mine use simply by modification of the enclosure, and by a rearrangement of components to allow more convenient dimensions. The basic components have a long history of industrial use and their characteristics, operation, reliability and maintenance requirements are known. They are generally produced in quantity and, therefore, are priced to take advantage of mass production. On the other hand, power equipment is more likely to be specially designed, is less likely to be designed for compactness, and is usually ordered with so many special features that mass production is out of the question. Power equipment is usually installed in locations where space is a minor problem, and very few of the available components are readily adaptable for underground use.

In most mines 4160 volts will maintain adequate load capacity and can cover enough area to be a practical transmission voltage. It is probable that there are now, and will be in the future, installations that will require use of a higher voltage for transmission circuits. At present there are some problems connected with its use which will probably limit the majority of installations to 4160 volts.

For use at the face, it appears that 460 volts will be standard. When supplied by a wye connected transformer, the line to ground voltage is 255 volts, which should be as safe a voltage as that currently used for direct current. The nominal system voltage is 440 volts. Maximum voltage on a 440-volt system may be as high as 480. In fact some equipment is rated at 480 volts on the name plate. An a-c motor will usually operate satisfactorily at plus or minus 10 percent of rated voltage. Using a 440-volt motor, therefore, an operating range of from 400 to 480 volts is available, or with a no load voltage of 480 full load voltage can drop to near 400 volts, and still give good operation.

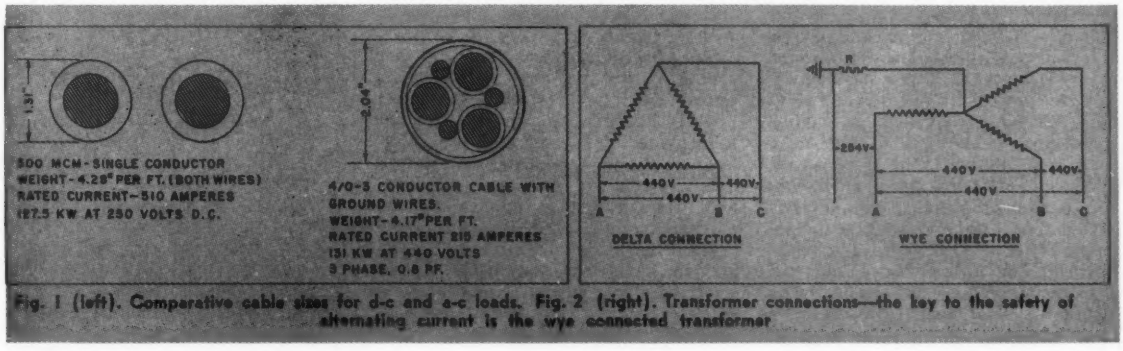


Fig. 1 (left). Comparative cable sizes for d-c and a-c loads. Fig. 2 (right). Transformer connections—the key to the safety of alternating current is the wye connected transformer

Equipment Used in Distributing A-C Power

An examination of the equipment used in distributing a-c power will help in demonstrating the inherent safety of a properly installed and maintained a-c system. Starting at the face, the trailing cables, and the distribution box control the distribution of power to the equipment. The trailing cable is the most vulnerable piece of equipment in the mine, and a large percentage of delays are due to cable troubles. The writer would like to say that alternating current changes this picture, but that is not true. However, cable faults on a-c cables seldom result in open arcing. For equipment such as shuttle cars, loaders, cutting machines and drills, four conductor cables are usually used

Fig. 3. The power center of the section is the distribution box

instead of the Type G illustrated in figure 1. This is due largely to factors of cost, flexibility and ease of repairing. Theoretically, a line to line fault in a four conductor cable should be just as probable as a line to ground fault. However, it has been our experience that even if the original fault is line to line, it develops into a line to ground and clears the circuit before the jacket of the cable is ruptured. There are some new developments in cable design on the market and it is to be hoped that a cable can be developed that will decrease the probability of line to line faults, and still be easy to splice and repair. The principal fault found with the new design cables is the difficulty in splicing the ground conductor, with the result that this conductor is often not spliced, or parts after being spliced. These troubles undoubtedly will be remedied.

The distribution box is the power center of the section. As shown in figure 3, it is a metal enclosed circuit breaker housing. A separate breaker is provided for each trailing cable. Each cable is separately protected against ground fault and overload, and this protection applies to the machine supplied by the cable. Cables connect to the distribution box through plug-in connectors, and no energized conductors are exposed, so that personnel danger is limited to those who remove the protective covers. The protective relays are accessible from the front, and no power conductors are exposed in checking or repairing these devices. Power is fed into the box through the large cable, and this cable and the distribution box itself are protected by the circuit breaker in the load center.

The load center, shown in figure 4, consists of an air cooled transformer, a low voltage circuit breaker and a grounding resistor. Provision is made in the housing for the installation of capacitors for power factor improvement. Power enters the load center through a 5000-volt cable by means of a plug-in connector. Two low voltage connectors are provided, and they are protected by a circuit breaker and ground fault and overload relays. The load center shown is 48 in. high, 11 ft long over the skids, and 54 in. wide. It weighs about 3000 lb and is skid mounted for easy moving. The cable providing incoming power is Type SHD, which is a high voltage trailing cable. Enough of this cable is provided to allow several moves of the load center and the excess is coiled out of the way, as shown in the figure.

Fig. 4. This load center, consisting of an air cooled transformer, a low voltage circuit breaker and a grounding resistor, is skid mounted for easy moving

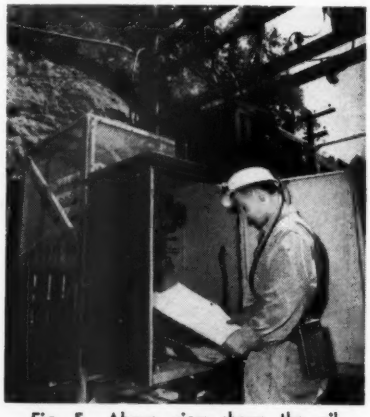


Fig. 5. Above view shows the oil circuit breaker and resistor that supplies power to the mine. The top of the breaker bushings can be seen in the background, the grounding resistor is at the left of the picture, and the control box, containing the relays, power supply for the checking circuit and the meters, is shown in the foreground

Detecting Ground Current in Trailing Cables

Referring again to figure 2, let us examine the method of detecting ground current in the trailing cables. In the distribution box it is necessary to protect a number of cables and to trip the faulty circuit without affecting the remainder. The three line leads leaving the transformer carry

currents that total zero if there is no ground fault. Any load supplied by these three lines will also total zero. If there is a ground on any line, however, part of the return current to the transformer will flow through the ground wire and the three line currents will no longer add up to zero. Therefore, a device which measures the total current in lines a, b and c will show a current equal to the ground current, and this current can be used to operate a relay to trip the circuit breaker. This relay can be set to operate on a very small current and can operate instantaneously, thus clearing the faulty circuit rapidly. There is one of these devices on each of the trailing cable connections. The cable connecting the load center and distribution box is protected by a relay in the transformer neutral. This relay on the load center is given a slight time delay, so that the trailing cable breaker can operate first and prevent unnecessary delay of production. If the trailing cable relay fails to operate, the load center relay will clear the circuit, acting as a back-up.

5000-Volt Cable Used

The high voltage supply to the load center, 4160 volts, is supplied by a 5000-volt cable, which makes up the transmission system. This cable is suspended from the roof on the trolley side of the track, and enough separation from the trolley is maintained to prevent mechanical damage to the cable from the trolley poles. The construction of the cable is similar to the three conductor cable shown in figure 1, except that (a) each conductor has a layer of metallic tape over its insulation and (b) one of the ground wires is replaced by an insulated wire. This wire is used to pass a very small direct current, about 15 milliamp, to the terminal of the cable at the load center. The return for this current is through the ground wire. Both the check wire and the ground wire are attached to the frame of the load center. As long as this check current flows, the main circuit breaker, supplying the 4160 volts to the mine, will remain closed. If either the check wire or the ground wire is broken, the circuit breaker will trip, and all power is removed from the cable. This assures that the ground circuit is continuous, reducing the possibility of stray currents and dangerous voltages. It also trips the supply breaker if a connector in the high voltage cable is opened in error without removing the power. This is accomplished by making the pole in the coupler carrying the checking current shorter than the others, so that the first movement of the coupler will trip the circuit breaker. In some cases key interlocking is used to prevent opening of the connectors before de-energizing the line. However, it is believed that this automatic precaution, together with strict rules of procedure, will accomplish the purpose when working on high voltage lines and not require the complication of key interlocking the transmission line.

Figure 5 shows the circuit breaker which supplies power to the mine. Ground fault relaying at this point is accomplished by measuring the current flowing in the neutral lead of the transformer. The ground resistor limits the fault current to about 50 amp, and with this current the voltage to ground anywhere except at the resistor is limited to less than 100 volts. The ground relay operates very rapidly, so that even this voltage appears only instantaneously.

Advantages of A-C Motors

So far, only the a-c power supply system has been considered. The use of a-c motors on mining equipment increases the safety of that equipment. The squirrel cage motor used to drive the mining equipment has no connections to the rotor and will not, except when faulted, create any spark. If it could be assumed that a motor would never fail, it would not even be necessary to use flame proof motors. However, even the most reliable machine will occasionally fail, and, therefore, flame proof motors are called for. It is much easier to construct and maintain a flame proof a-c motor than a d-c motor. There is no necessity to provide hand holes for the servicing of brushes and commutators. Controls for a-c motors are much simpler than those for d-c motors, eliminating resistors and using only a single contactor, or two contactors, for reversing service, thus permitting smaller control enclosures. A ground anywhere on the machine will give only about 15 volts to ground, and that only for the fractional part of a second required for the relays to clear the circuit, so that the hazard of sparks between machines is greatly reduced. The characteristics of a squirrel cage motor requires good voltage to operate, and thus one cause of overheating of motors and cables is eliminated.

With alternating current it is a simple matter to obtain any desired voltage, by means of transformers. This allows the use of 110 volts for area lighting, and the use of rugged 12 or 24-volt lights on machines. Although this phase of face safety has not been used extensively, the ready availability of proper voltage will make area lighting much more attractive.

Increased Safety, Production

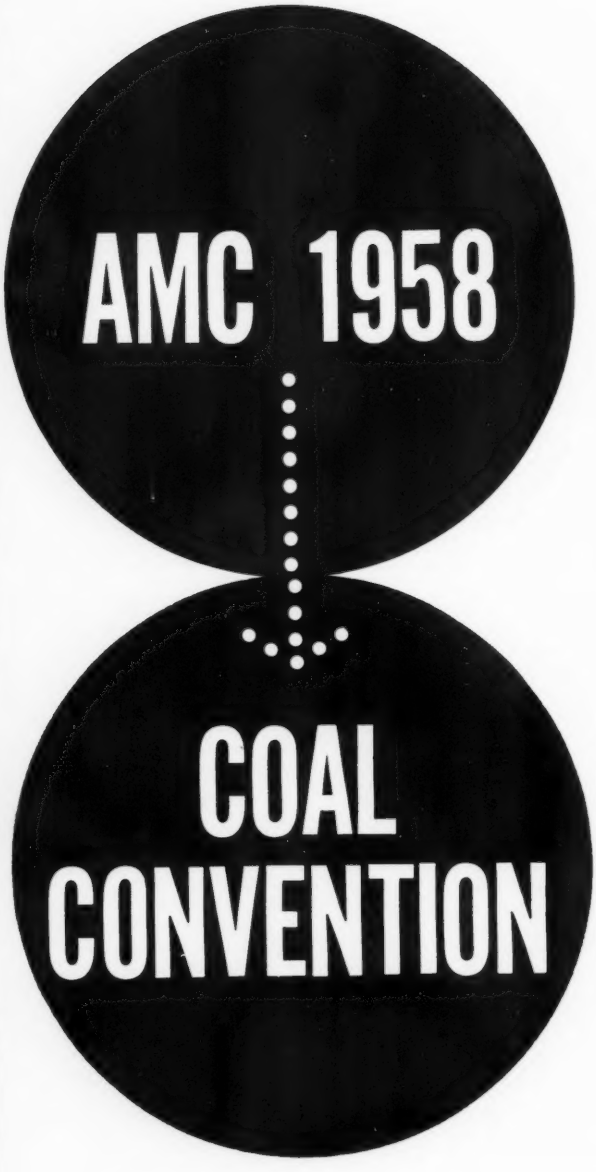
In summation, the use of alternating current offers improved safety in several ways:

1. **Hazards of mine fires and dust and gas ingition by electric arc is greatly reduced. Safer trailing cables and better protection against faults, greatly reduce the possibility of an an open arc which can ignite coal dust or other flammable material.**
2. **Hazard of gas ingition by face equipment is reduced. The elimination of moving contact parts on motors, elimination of resistors and reduction of controller size reduces the possibility of gas ingition. The low voltage to ground and the rapid and accurate clearing of ground faults reduces the possibility of sparks between machines.**
3. **Shock hazard to personnel is greatly reduced. There are no exposed conductors. Any fault that might place potential on equipment is removed rapidly and its intensity is controlled at a low value. Hazards due to arcing faults are also greatly reduced, if not entirely eliminated.**
4. **Availability of low voltage for lighting opens the way for economical and efficient lighting of the face area, with a corresponding improvement of working and safety conditions in that area.**

It should be remembered, however, that these results can be obtained only if the a-c system is properly engineered, properly installed, and properly maintained. Introduction of a-c power to the face area is not a reason to neglect proper maintenance. The potentials available will only be achieved if proper procedures are followed in keeping the equipment in condition to operate as designed.

With proper engineering, installation and maintenance, companies can achieve not only more and cheaper production, but greatly improved safety as well.

"You'd think that Gark would install a few labor-saving devices."



Emphasizing the theme "Research for Progress," the Annual Convention in Cincinnati will bring together progressive mining men from all over the country for an appraisal of where the coal industry stands and where it is headed.

COAL will be King in Cincinnati, May 5-7, when this great industry gathers for the 1958 Coal Convention of the American Mining Congress. An outstanding technical program, two business luncheons with guest speakers John L. Lewis, George M. Humphrey and Bob Feller, a fine program of evening entertainment, a full schedule of ladies events and the opportunity to meet old friends and make new ones combine to make this meeting one that no coal mining man will want to miss.

Featuring an "all star cast" of speakers, the program of convention addresses has been designed to answer pressing problems that face all branches of the industry today. Leaders in their respective fields will describe new and better ways to mine the basic raw material that is so important to America's industrial might. Progressive mining men from all over the country, looking for new ideas and equipment that will cut costs, improve efficiency and promote safety, will gather to hear and discuss the nearly 50 reports dealing with all aspects of coal production.

Many of those engaged in the production of metals and industrial minerals have already utilized many of coal mining's advances, and will be present to learn what can be applied to their particular fields.

A hard-working industry committee headed by James C. Gray, administrative vice-president—raw materials, U. S. Steel Corp., has arranged a balanced and comprehensive program of technical papers for the several convention sessions. Built around the theme "Research for Progress," the discussion will cover the latest developments in underground and strip mining, coal preparation,

haulage, power, health and safety, problems of continuous mining and industry research. A look at the final convention program on the following pages, with its imposing list of speakers, will show why so many mining men are making plans to attend the 1958 Coal Convention.

Each of the 11 sessions will pinpoint topics uppermost in the minds of coal operators today. The opening session on Monday, May 5, will deal with research. The human side of the subject will be discussed in an address pointing out the real need of a deep personal interest in research. In contrast the second speaker, dealing with the technical aspects of coal research, will compare the work being done in this country with that in Europe, and report on the progress being made by researchers for the benefit of coal users.

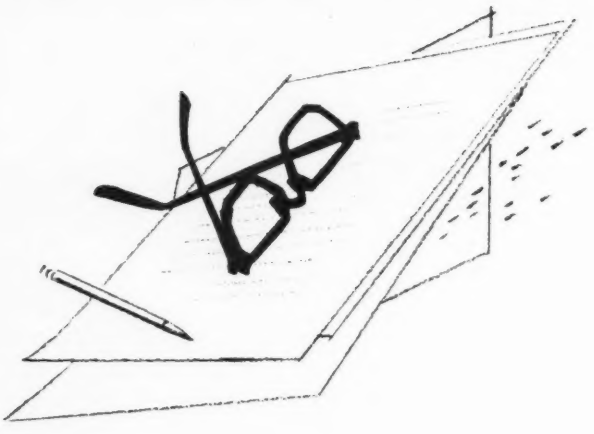
On Monday afternoon strip mining and underground power will occupy the attention of convention-goers. The strip mining session will emphasize the latest advances in stripping practices and innovations in the use of ammonium nitrate as an explosive. The question of a-c power for underground coal mining, a subject receiving particular attention at this time, will be thoroughly aired at the underground power session.

The first of two coal preparation sessions will be held Tuesday morning. Topics to be discussed include fine coal preparation, benefits of reducing circulating solids, pumping coal and refuse, and recent advances in thermal drying. An engineering approach to safety will be stressed at the other Tuesday morning meeting, which covers mine lighting, flame resistant belting, safety advantages in the use of a-c power underground, and rock dusting.

James C. Gray
Administrative Vice-President — Raw Materials, U. S. Steel Corp.
Chairman, National Program Committee

L. C. Campbell
Retired Vice-President, Eastern Gas & Fuel Associates
Chairman, Coal Division

Jack H. How
President, Western Machinery Co.
Chairman, Manufacturers Division



Haulage and continuous mining will be considered Tuesday afternoon. At one session, combination haulage and recent developments in shuttle cars will be discussed, together with a paper on an operations research approach to mine haulage. Maintenance, performance standards, service haulage behind continuous mining equipment, continuous mining in thin seams, and continuous mining productivity will be covered at the other session.

On Wednesday morning conventional mining and coal preparation will hold sway. Industrial engineering, maintenance and high production in thin seams will be dealt with at one session. At the final session on coal preparation, one of the speakers will predict the future demands as to coal quality by the electric utility industry—a subject of prime interest not only to preparation men but to the entire industry. Others will deal with the automation, dense media cleaning, and nuclear irradiation of coal for use with diesel fuel.

Howard I. Young
President, American Zinc, Lead & Smelting Co.
President, American Mining Congress

Julian D. Conover
Executive Vice-President
American Mining Congress

The final sessions on continuous mining and strip mining will be held Wednesday afternoon. Papers on Russian developments in continuous mining equipment design will add spice to the first meeting, which will also include talks on ventilation problems, roof support, and the design of continuous mining systems. The second session will highlight a symposium on developments in strip mine haulage, along with a paper on continuous mining in strip highwalls.

J. W. Woomer, J. W. Woomer & Associates, is Chairman of the Floor Committee.

One of the greatest benefits to those attending the convention sessions will be the information that comes forth spontaneously in floor discussions. As in the past, questions and observations from the audience will be invited.

John L. Lewis to Speak

The two business luncheons will feature talks on subjects in which all mining men are interested. On Monday John L. Lewis, president, United Mine Workers of America, will be the guest speaker. He will be introduced by George M. Humphrey, former Secretary of the Treasury, now chairman of National Steel Corp. Both Lewis' remarks and those of Mr. Humphrey will be of special interest to the industry.

Coal miners are known the country over for their fervent interest in baseball. Hence, the Tuesday luncheon will also be a must on their program. Bob Feller, former pitching star with the Cleveland Indians and currently candidate for baseball's Hall of Fame, will express his views on the player's position in our national pastime.

For the Ladies

Ladies are urged to come to Cincinnati for the meeting, and a special program of events has been arranged for their enjoyment. On Monday the American Mining Congress will be host at a tea and reception in the Presidential Suite at the Netherland Hilton.

On Tuesday the ladies will journey to the Maketewah Country Club for a leisurely luncheon. Miss Phyliss Swisher of the Cincinnati and Suburban Bell Telephone Co. will give an informative,

(Continued on page 59)

SESSION CHAIRMEN

P. P. Ferretti
Vice-President in Charge of Operations, Pocahontas Fuel Co., Inc.

William A. Gallagher
Vice-President, Stonega Coke & Coal Co.

Oscar A. Glaeser
President, United States Fuel Co.

J. L. Hamilton
Executive Vice-President, Island Creek Coal Co.

R. J. Hepburn
Vice-President, The United Electric Coal Cos.

Robert H. Hughes
President, Clinchfield Coal Co.

Wilmot C. Jones
Vice-President, Jeddo-Highland Coal Co.

George L. Judy
Vice-President, Consolidation Coal Co. (W. Va.), Division of Pittsburgh Consolidation Coal Co.

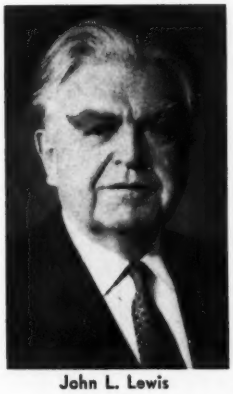
Ralph E. Kirk
Consulting Engineer, Birmingham, Ala.

S. F. Sherwood
President, Stonefort Corp.

James C. Gray is also a Session Chairman

LUNCHEON SPEAKERS

Two special luncheons will be featured. On Monday, May 5, John L. Lewis and George M. Humphrey will address the convention. Bob Feller will be the principal speaker at the luncheon Tuesday, May 6.



John L. Lewis

George M. Humphrey

Bob Feller

Robert Akre

Dr. W. H. Alexander

R. L. Anderson

Ernest W. Bruns

Robert G. Bunch

M. C. Chang

A. E. Coddington

Lowell E. Copeland

Jesse F. Core

Ralph B. Dean

G. C. Dyar

Frank Gilbert

Robert R. Godard

David E. Hamilton

Martin R. Heckard

MONDAY—MAY 5

9:30 A.M.—Pre-Session Motion Picture

"X Minus 80 Days" (Launching America's First Satellite)

10:00 A.M.—RESEARCH FOR PROGRESS

Chairman: JAMES C. GRAY, Administrative Vice President — Raw Materials, U. S. Steel Corp., Pittsburgh, Pa.; Chairman, National Program Committee

The Human Side of Research

DR. W. H. ALEXANDER, Pastor, The First Christian Church, Oklahoma City, Okla.

Research in the Coal Industry

DR. A. A. POTTER, President, Bituminous Coal Research, Inc., Lafayette, Ind.

12:15 P.M.—LUNCHEON

Presiding: L. C. CAMPBELL, Pittsburgh, Pa.; Chairman, Coal Division, American Mining Congress

Guest Speaker: JOHN L. LEWIS, President, United Mine Workers of America

Mr. Lewis will be introduced by GEORGE M. HUMPHREY, Chairman, National Steel Corp.

1:45 P.M.—Pre-Session Motion Picture

"Coal, Servant of Mankind" (The United Electric Coal Cos.

2:15 P.M.—STRIP MINING

Chairman: R. J. HEPBURN, Vice-President, The United Electric Coal Cos., Chicago, Ill.

Two Seam Stripping and Parting Removal

FRANK GILBERT, Superintendent, River Queen Mine, Peabody Coal Co., Greenville, Ky.

Current Practices in Anthracite Stripping

A. E. CODDINGTON, Vice-President, Carey, Baxter & Kennedy, Inc., Mahanoy City, Pa.

Discussion:
JAMES R. BAZLEY, Vice-President, J. Robert Bazley, Inc., Pottsville, Pa.

Developments in Ammonium Nitrate Blasting

ROBERT AKRE, Superintendent of Drilling and Blasting, The Maumee Collieries Co., Terre Haute, Ind.

JAMES HYSLOP, President, Hanna Coal Co., Cadiz, Ohio.

●

1:45 P.M.—Pre-Session Motion Picture

"Forests for the Future" (Forest Conservation)

2:15 P.M.—UNDERGROUND POWER

Chairman: GEORGE L. JUDY, Vice-President, Consolidation Coal Co. (W. Va.) Division of Pittsburgh Consolidation Coal Co., Fairmont, W. Va.

Factors in Evaluating and Selecting A-C Power Systems for Underground Coal Mining

C. R. HUFFMAN, Staff Electrical Consultant, Donegan Coal & Coke Co., Richwood, W. Va.

Discussion:

DAVID E. HAMILTON, Application Engineer—Mining, General Electric Co., Schenectady, N. Y.

Selection of A-C Distribution Equipment

JOHN A. STACHURA, General Superintendent, Enoco Collieries, Bruceville, Ind.

Operating Experience with A-C Mining Equipment

J. H. SHERRARD, JR., Chief Engineer, and ANDREW RUSNAK, Maintenance Supervisor, Johnstown Coal & Coke Co., Portage, Pa.

●

2:30 P.M.—ANNUAL MEETING MANUFACTURERS DIVISION

6:30 P.M.—COAL MINERS PARTY
Castle Farm, Cincinnati
Cocktail hour, dinner, dancing and entertainment

TUESDAY—MAY 6

9:00 A.M.—Pre-Session Motion Picture

"The Chocolate Tree" (Story of Cocoa)

9:30 A.M.—COAL PREPARATION

Chairman: R. H. HUGHES, President, Clinchfield Coal Co., Dante, Va.

Fine Coal Preparation and Closed Circuit Operation

M. C. CHANG, Research Mineral Engineer, Research Department, Crucible Steel Company of America, Pittsburgh, Pa.

Benefits of Reducing Circulating Solids

J. J. REILLY, Coal Preparation Superintendent, Vesta-Shannopin Preparation Plant, J & L Steel Corp., California, Pa.

Pumping Coal and Refuse

PAUL LEVIN, Project Engineer, Allen & Garcia Co., Chicago, Ill.

Recent Advances in Coal Thermal Drying

F. R. ZACHAR, Consulting Mining Engineer, Morgantown, W. Va.

●

9:00 A.M.—Pre-Session Motion Picture

"Frontier Vacation Land" (A Trip Through Yellowstone Park, The Grand Canyon and the deserts of Arizona)

9:30 A.M.—SAFETY

Chairman: RALPH E. KIRK, Consulting Engineer, Birmingham, Ala.

Mine Lighting

ROBERT R. GODARD, Electrical Engineer, U. S. Steel Corp., Uniontown, Pa.

Experience with Flame Resistant Belting

DONALD B. SHUPE, Mine Superintendent, Eastern Gas & Fuel Associates, Barrett, W. Va.

Safety Advantages in the Use of A-C Power Underground

RALPH M. HUNTER, Manager, Electrical and Mechanical Department, Rochester & Pittsburgh Coal Co., Indiana, Pa.

Rock Dusting in Multiple Shift Operations

C. E. LINKOUS, Director of Safety, Island Creek Coal Co., Holden, W. Va.

(Continued on next page)

12:15 P.M.—LUNCHEON

Presiding: JACK H. HOW, President, Western Machinery Co.; Chairman, Manufacturers Division, American Mining Congress

Address: BOB FELLER, All-Time Baseball Great

1:45 P.M.—Pre-Session Motion Picture

"After the Harvest" (Trading on the World's Largest Commodity Exchange)

2:15 P.M.—HAULAGE

Chairman: W. A. GALLAGHER, Vice-President, Stonega Coke & Coal Co., Philadelphia, Pa.

Recent Developments in Shuttle Cars

A. L. LEE, Manager, Lee Engineering Division, Pittsburgh Consolidation Coal Co., Columbus, Ohio

Combination Belt and Mine Car Haulage

C. WARD PADGETT, General Superintendent, Southern Illinois Division, Bell & Zoller Coal Co., Zeigler, Ill.

M. H. SHUMATE, Assistant General Manager, Truax-Traer Coal Co., Kayford, W. Va.

Discussion:

E. M. PACE, General Superintendent, and E. H. ROBERTS, Chief Mining Engineer, Inland Steel Co., Wheelwright, Ky.

An Operations Research Approach to Mine Haulage

ERNEST KOENIGSBERG, Head, Operations Research Section, Midwest Research Institute, Kansas City, Mo.

Discussion:

O. D. MCDANIEL, Manager, Industrial Engineering, Old Ben Coal Co., West Frankfort, Ill.

●

1:45 P.M.—Pre-Session Motion Picture

"The Mark of 'C' " (Story of a Revolutionary War Hero—a Baker)

2:15 P.M.—CONTINUOUS MINING

Chairman: J. L. HAMILTON, Executive Vice-President, Island Creek Coal Co., Huntington, W. Va.

Continuous Mining in Thin Seams

W. J. B. MAYO, Division Manager, Eastern Gas & Fuel Associates, Melcroft, Pa.

Performance Standards for Continuous Mining

DONALD C. HOWE, Mining Industrial Engineer, Vesta-Shannopin Coal Division, J & L Steel Corp., California, Pa.

Continuous Mining Productivity

R. L. ANDERSON, Supervisory Commodity-Industry Analyst, U. S. Bureau of Mines, Washington, D. C.

John L. Henley

A. D. Henry

Donald C. Howe

C. R. Huffman

Ralph M. Hunter

James Hyslop

John E. Kaites

Donald S. Kingery

Ernest Koenigsberg

Wm. C. Laidlaw

A. L. Lee

Paul Levin

Maintenance of A-C Continuous Mining Equipment

L. T. LINDSAY, Shop Foreman, Sunnyside Mine, Kaiser Steel Corp., Sunnyside, Utah

Analysis of Service Haulage Behind Continuous Mining Equipment

GERALD VON STROH, Director of Mining Development Committee, Bituminous Coal Research, Inc., Huntington, W. Va.

WEDNESDAY—MAY 7

9:00 A.M.—Pre-Session Motion Picture

"Idaho and Its Natural Resources" (A Travelogue)

9:30 A.M.—CONVENTIONAL MINING

Chairman: OSCAR A. GLAESER, President, United States Fuel Co., Salt Lake City, Utah

High Production in Thin Seams

J. L. MCQUADE, President, Tioga Coal Corp., Tioga, W. Va.

Foreman Training

JOHN E. KAITES, Industrial Engineer, Berwind-White Coal Mining Co., Windber, Pa.

Preventive Maintenance

JOHN L. HENLEY, Master Mechanic and Chief Electrician, Elk River Coal & Lumber Co., Widen, W. Va.

Modern Approach to Equipment Maintenance

RALPH B. DEAN, Administrative Assistant, Lorado Coal Mining Co., Columbus, Ohio

●

9:00 A.M.—Pre-Session Motion Picture

"The World that Nature Forgot" (The Invisible World of Atoms and Molecules)

9:30 A.M.—COAL PREPARATION

Chairman: WILMOT C. JONES, Vice-President, Jeddo-Highland Coal Co., Jeddo, Pa.

Reducing Coal Preparation Costs Through Automation

GEORGE H. MORRIS, Preparation Engineer, Indiana Division, Peabody Coal Co., Boonville, Ind.

Advances in the Art of Dense Media Cleaning

EMERY MILLIGAN, Preparation Manager, Freeman Coal Mining Corp., Marion, Ill.

A Prediction of Future Demands by the Electric Utility Industry in Coal Quality

R. H. WOLIN, Assistant Chief Engineer, Combustion Engineering Co., Inc., New York, N. Y.

Research on the Nuclear Irradiation of Coal for Use with Diesel Fuel

RAY MCBRIAN, Director of Research, The Denver & Rio Grande Western Railroad Co., Denver, Colo.

(Continued on next page)

L. T. Lindsay

C. E. Linkous

Ray McBrian

O. D. McDaniel

J. L. McQuade

C. E. McWhorter

W. J. B. Mayo

Emery Milligan

George H. Morris

E. M. Pace

C. Ward Padgett

Dr. A. A. Potter

Wednesday, May 7, Continued

1:30 P.M.—Pre-Session Motion Picture

"Jamaica Flavor" (Scenery, Culture, and History from the Tropical Caribbean Island of Jamaica)

2:00 P.M.—CONTINUOUS MINING

Chairman: P. P. FERRETTI, Vice President, Pocahontas Fuel Co., Inc., Pocahontas, Va.

Ventilation Problems in Connection with Continuous Mining Systems

DONALD S. KINGERY, Chief, Mine Ventilation Section, U. S. Bureau of Mines, Pittsburgh, Pa.

Roof Support with Continuous Mining

G. C. DYAR, General Superintendant of Mines, Alabama By-Products Corp., Birmingham, Ala.

Designing Continuous Mining Systems

JESSE F. CORE, Vice-President — Operations — Coal, U. S. Steel Corp., Pittsburgh, Pa.

Russian Developments in Continuous Mining Equipment Design

C. E. MCWHORTER, Mining Engineer, Goodman Manufacturing Co., Chicago, Ill.

Discussion:

T. REED SCOLLON, Chief, Division of Bituminous Coal, U. S. Bureau of Mines, Washington, D. C.

1:30 P.M.—Pre-Session Motion Picture

"The Eighth Sea" (Constructing the St. Lawrence Seaway)

2:00 P.M.—STRIP MINING

Chairman: S. F. SHERWOOD, President, Stonefort Corp., Indianapolis, Ind.

Continuous Mining in Strip Highwalls

A. D. HENRY, General Superintendent, The Powhatan Mining Co., Bloomingdale, Ohio

Developments in Strip Mine Haulage

(A Symposium)

ROBERT G. BUNCH, Partner, Bunch Construction Co., Sharples, W. Va.

WILLIAM C. LAIDLAW, Production Engineer, The Enos Coal Mining Co., Oakland City, Ind.

ERNEST W. BRUNS, President, Bolt Mining Co., Beckley, W. Va.

LOWELL, E. COPELAND, President, Beckley Coal & Coke Co., Richwood, W. Va.

MARTIN R. HECKARD, Superintendent, Rapatee Operations, Midland Electric Coal Corp., Canton, Ill.

7:00 P.M.—ANNUAL BANQUET

Toastmaster: JAMES C. GRAY, Administrative Vice-President—Raw Materials, U. S. Steel Corp., Pittsburgh, Pa.; Chairman, National Program Committee

Brief introductions of honor guests, followed by an outstanding entertainment program

J. J. Reilly

E. H. Roberts

T. Reed Scollon

J. H. Sherrard, Jr.

M. H. Shumate

Donald B. Shupe

John A. Stachura

Gerald von Stroh

R. H. Wolin

F. R. Zachar

James R. Bazley

Andrew Rusnak

Photos not available

(Continued from page 52)

humorous talk, "Is Your Voice You?"

Wednesday, a unique "Pink Party" will be held at the Sheraton-Gibson Hotel. After a delicious luncheon, Leon E. Mattler will give an unusual demonstration of scientific hand-writing analysis.

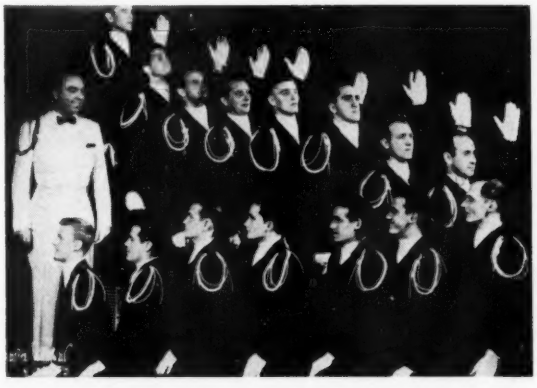
Ladies' headquarters will be the Julep Room on the third floor on the Netherland Plaza. Someone familiar with all Cincinnati's points of interest and the best places to shop will be there at all times to assist the visitors.

Entertainment

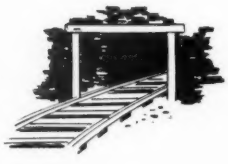
An outstanding entertainment program has been arranged for the Convention. Those who have attended other AMC Coal Conventions will remember the gay time they have always had at the Coal Miners Party. This year it will be held at Cincinnati's famous Castle Farm. An informal cocktail hour will be followed by dinner, dancing and a fine floor show. Bus transportation will be provided to and from downtown.

The annual "Speechless" Banquet is always the climaxing event of the Coal Convention. Mr. and Mrs. Mining Man will gather for a superb dinner and a stellar program of entertainment that will live long in their memory. This year they will enjoy a pleasure-packed evening with Virginia Sellers, petite soprano personality, and the Winged Victory Chorus, 17 young ex-Gi's whose medley of popular music has enchanted audiences throughout the world. As usual, the dinner will be informal. There will be no speeches, only brief introductions of the honored guests. All tables are reserved.

If you haven't yet made your plans, now is the time. Don't miss the 1958 Coal Convention with its well-balanced program, outstanding array of entertainment and the enjoyment of meeting old friends and making new ones.



FAIRMONT–Helpful Partner to the Coal Industry!

This is the service mark **FAIRMONT** that has been a beacon to the coal industry  for over sixty years Fairmont whose engineering skill has led to coal cleaning plants of better than 99% separating efficiency and which helps the operator get the upgraded product to market and delivered at top dollar value. Call or write us today.

FAIRMONT MACHINERY COMPANY

FAIRMONT, WEST VIRGINIA

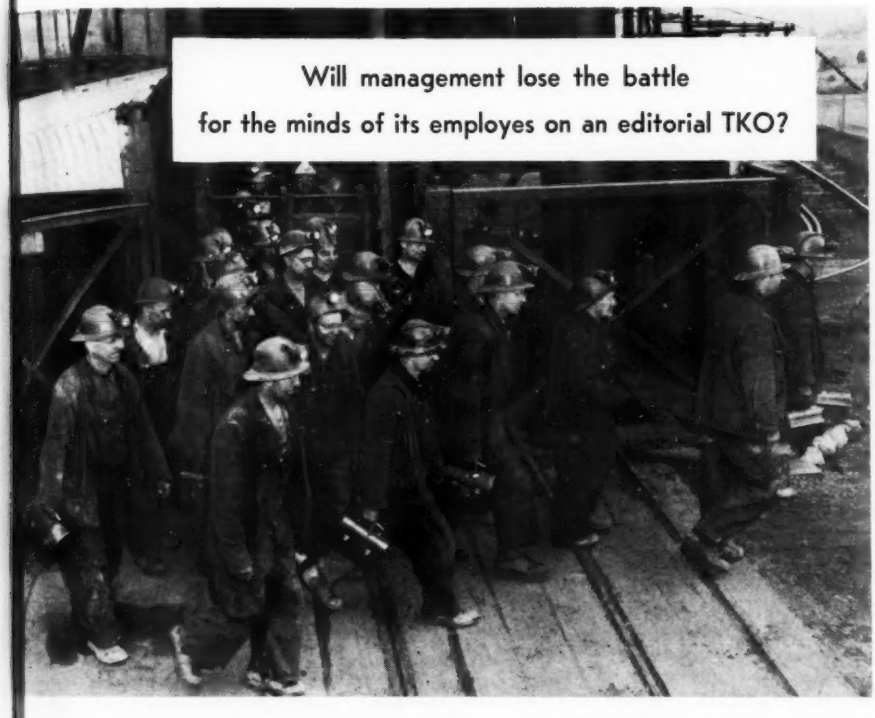
DESIGNERS AND CONSTRUCTORS OF COMPLETE COAL PREPARATION PLANTS USING BOTH WET AND DRY CLEANING, CENTRIFUGAL AND THERMAL DRYING.

COMMUNICATIONS—

A Job For Top Management

By ROBERT A. HARPER

Assistant Director, Public Relations
Koppers Co., Inc.



IN a few months America will observe its 182nd birthday.

It will also mark the 182nd year of a wonderful experiment in human affairs. That the experiment was a success is obvious. Today we're the most powerful, influential, best-governed people on earth. Today also we're the most culturally and materially abundant nation on earth.

The experiment in freedom has proven itself. It has proven itself so well that the thinking man in this nation is looking for a better tomorrow, a better year next year, and still better years beyond that.

Industry and labor both believe that we stand at the gate of a new era of progress—an age of scientific and technological advancement. Experts say we can increase our standard of living about three per cent a year—which means that more people will be able to possess more than they have today.

Yes, we can and will raise our standard of living—build an even better America tomorrow, if . . . if we don't take a different path than that which has led us to where we are. The future of America lies in the minds of men and in the vigor with which they pursue plans which public opinion holds to be right.

Pascal said, "Force and not opinion is the queen of the world; but it is opinion that uses the force." There are honest differences of opinion, but one of the tragedies is that too many are formed without proper knowledge of the facts. Thus, education becomes the prime factor in molding opinion and where there are two sides to a question—as there usually are—the proponents and the opponents often line up in a battle to win the minds of men. Often these battles involve conflicting philosophies and the side which is most vocal has the best chance of winning. The side that speaks not at all has no chance—no matter how right it might be.

Today, labor and management have conflicting philosophies on many issues of importance.

Industry has proposed ways for our nation to avoid and correct serious errors of economic policy—errors that industry strongly believes could discourage and impede progress.

Labor, too, is working for a better tomorrow and for a better world in which to live. In many instances labor and management have linked arms because of mutual interest and belief in the same goal. But, in some of the major areas of economics and politics, labor leaders and management are as different in their beliefs as night and day.

It is these differences that are the subject of this article. What are some of the more vocal labor leaders doing to attract the minds of men? What is management doing? In other words, who's saying what to whom and how forcefully? Based on some pretty careful observations during the past 2½ years, management is taking a licking. It's taking a licking in this battle to win support for the American economic system as it has developed under private enterprise. The economic system that employers believe in is vastly different from the economic system that would inevitably result from the adoption of programs advocated by some union leaders. And whether these union leaders know it or not, some of the things they advocate will move America directly on the road to socialism.

Perhaps you know already that management is lagging in this battle, perhaps you don't. But, the fact is that much of management isn't telling its story adequately.

Presentations of Ideologies Differ Greatly

Let's take a look first—and in brief—at the aims of members of management and certain representatives of union organizations in the fields of economics and politics.

In the lineup, the economic system of the *union leader* is built around a desire for government regulation and protection: for high taxes on high incomes and on business, and high exemptions and low taxes on moderate incomes; for guaranteed jobs and wages; for an increasing employer responsibility for worker income, welfare and retirement regardless of costs.

The economic system of *employers* has as its core: the conviction that increasing government controls and interference in the end will hurt both industry and workers; that taxes which don't exceed 35 percent even in the top brackets and a broader base for carrying the costs of running America will lead to the greatest prosperity for all; that there is no way in which either jobs, wages, or benefits can be guaranteed if sales are not made and profits are not earned.

Both sides have assembled their arguments. Both sides have their economists and technicians preparing the evidence. Both sides are trying to get their views before key people. But, so far, management has elected to fight with one arm tied behind its back.

Oh, management people do a fine job selling themselves. In conventions and professional meetings speaker after speaker extols the virtues of the American economic system as it has developed under private enterprise. But, from there on out it goes into low gear. Once outside the walls of the meeting rooms, many members of management are failing to use all of the resources at their fingertips which would help expose the economic fallacies propounded by some union leaders. Management is like the ostrich that hides its head in the sand at the first sign of danger. Management's conservatism and what seems to be a cautious, negative approach to controversial issues in telling its story to employes has created misunderstanding, even disloyalty, among the very people it wishes to influence most. And, by not doing the job it should do, this antagonism towards management is permitted to spread. It permits, without challenge, the spreading of ideas which would hurt businesses and the jobs of employes.

In contrast, union leaders are vigorously and effectively driving home to their members their arguments and their point of view. Week after week they pour out a flood of carefully planned, well-written articles which—irrespective of geographic area or union identity — advocate more government participation in the economy. These articles reflect a solid labor front on almost every major policy question. A careful study of only five union publications which reach most plant people in the U. S., such as *The AFL-CIO News, The American Federationist, The Machinist, United Rubber Worker,* and *District Fifty News,* will prove this point. Incidentally, there are about 495 local union publications as well. Editorial material appearing in the local publications contains the same basic philosophy as found in the national union issues.

A native of Ohio, Robert A. Harper attended Akron University and Northwestern University. He joined Koppers Co., Inc., in 1952 as editor of Koppers News after having worked five years as a member of the news staff of the Wheeling, W. Va., News Register. His duties now also include those of assistant director of public relations. Harper is a member of the Executive Board of the Industrial Communications Council, the Associated Editors Society of Pittsburgh, and the Industrial Editors Advisory Committee to the United States Treasury Department, Savings Bond Division.

Study of Union and Management Publications Made

On the other hand, a similar study of management publications—the so-called house organs of industry and business, large and small—*reaching the same membership as union publications*—fails, *with a few exceptions,* to reveal similar articles vigorously and candidly telling workers what management feels is good for America and why. Usually well written and often beautifully printed, these management-edited publications cover mainly employe social news, company sports activities, and news reports about the company and its products. For the most part they remain conspicuously silent on such basic subjects as the profit system or on key current issues before the national and state legislative bodies.

With but few exceptions, articles published by union newspapers and magazines are aimed at advancing a well-planned program of national socialistic legislation, and in most instances subject matter is more editorial than newsworthy.

Koppers initiated a study and analysis of major union and management publications in 1954. Comparisons were made on subject matter, frequency of publication, the type of presentation, and the kind of audience reached. Our original study covered material published during a five-month period in 1954—May 1 through September 30. Since that time the company has continued to analyze the same publications or others that have come to its attention. A clipping file was started to contain the different subjects which were found in union and management publications. Originally, material was filed concerning 26 different economic, legislative and political subjects which were published more frequently than any other subject. Today, that file has grown to some 93 subjects covering union and management goals in economics, national and state legislation, and politics.

About 99 percent of the material presenting management's side was clipped from trade association publications. Such trade associations included the Chamber of Commerce of the United States, the National Association of Manufacturers, the National Industrial Conference Board, the Tax Foundation, and others. But — these publications just don't reach the average union man.

What management publications do reach the average union man? Those sponsored and paid for by the companies—the newspapers and magazines usually called "employe publications." These just don't stack up well against union publications in presenting hard-hitting stories plainly stating managements' views on current controversial subjects.

The company has completed a special study to determine whether or not companies are becoming more vocal on controversial subjects in their employe publications. The results are discouraging.

This special study was made to determine how frequently and how forcefully the union and company publications are talking on these controversial subjects, and only union and company publications appearing since the first of 1957 were reviewed. Five issues, which have been considered most controversial and which have been given prominent attention by state and federal legislators as well as by leaders of labor and industry, were selected. They were:

1. **Price-Wage Spiral**
2. **The Right-To-Work Laws**
3. **Corporate Profits**
4. **Proposed Revisions of the Taft-Hartley Law**
5. **Extension of the Minimum Wage Act**

Union Offers Hard-Hitting Articles

First, take a look at union publications. An analysis was made of the seven most widely circulated union publications. These seven were: *The AFL-CIO News, The International Chemical Worker, Steel Labor, The United Automobile Worker, The United Mine Workers Journal, The Machinist,* and *Union News* (official publication of the Oil, Chemical and Atomic Workers International). They were analyzed to determine what they have done in the first quarter of 1957 to present the union leader's viewpoint to rank and file members, on the five subjects mentioned before.

It was found that:

A. A total of 103 articles were printed about these subjects. Without exception all articles presented a definite opinion propounded by union leaders. The opinion was expressed either in the headline or in the body of the text or both. The text was not necessarily written as an editorial, such as we read in our daily newspapers. Instead the union editor very ably uses a legitimate news peg of public interest on which to "grind his ax."

B. Of the 103 articles:

(a) 35 were written about the Price-Wage Spiral and in most instances "profits"

were blamed for inflation.

(b) 27 were written about the Right-to-Work Laws with these laws being labeled "right-to-wreck" laws.

(c) Nine were written about Corporate Profits emphasizing that profits continued upward in 1956 at a rate higher than generally prevailed in wage increases.

(d) Nine were written about the proposed revisions of the Taft-Hartley Law—some continuing to criticize the law as a "slave-labor" law, and others critical of the Administration and Congress for not doing something about inequities.

(e) 23 were written about the Extension of the Minimum Wage Act advocating that the law give coverage to an additional 9,000,000 people over and above the 2,500,000 people which the Administration wants to include under the law.

C. An estimated 15 percent of the space of union publications was utilized to present viewpoints and salient information on the five controversial subjects.

Yet, this is only part of the tremendous propaganda program union members are getting. There is a lot more. And, any of this information union leaders are handing out gives only one point of view.

Now, take a look at a few of the examples of material appearing in the seven union publications on these five controversial subjects. Major policy speeches of labor leaders are featured. One dominant theme throughout many of the articles is labor's political role in the legislative halls of America. Listen to these headlines—Aren't they calculated to arouse the ire of union members?

BIG BIZ SPREADS THE LIE THAT LABOR IS RESPONSIBLE FOR GREEDY PRICE INCREASES

Here's what the first and second paragraphs say:

"A major campaign, using all the gimmicks of propaganda and public relations, is under way to try to undermine ability of workers to get decent wage increases through the collective bargaining processes.

"Big business 'theorists' and longhairs are writing studies to build a case against wage boosts. Corporations are weeping crocodile tears that wage costs are the only reasons for price increases. President Eisenhower has saluted the same idea."

Pretty potent stuff, isn't it? Here's another headline.

USW, OTHER UNIONS SHOW WAGE GAINS DON'T CAUSE INFLATION

This is how the first part of the text reads:

"Top labor economists, appearing before the Joint Committee on the Economic Report, have blasted growing efforts to blame the high cost of living on wage boosts. The truth is, they told the committee, that industry and business, especially those with monopolistic power, are gathering in huge profits by unjustified price increases while blaming labor for increased costs."

Here's one on the Right-To-Work Law just passed by the Indiana Legislature.

NEW REPUBLICANISM AND $$$ BEHIND INDIANA "WRECK" LAW

That's the headline. Here's part of the text.

"The Indiana Senate, by a vote of 27 to 23 has placed its stamp of approval on a measure to prohibit all forms of union security."

Pay particular attention to the last part of the union's contention that a right-to-work law is a measure "to prohibit all forms of union security." How about this headline on profits?

U. S. STEEL CORPORATION, PRETTY PROFIT PICTURE—NET EARNINGS—$347,865,000

A secondary head reads:

U. S. STEEL CHIEF SAYS WAGE BOOSTS WERE UNEARNED AND INFLATIONARY

Other headlines and stories on these five controversial issues are similar.

NAM PROPAGANDA MILL GRINDS OUT LINE FOR PUBLIC THROUGH PRESS, RADIO, AND SCHOOLS

AFL-CIO ASKS INVESTIGATION OF EXCESSIVE PROFIT MARGINS

"WRECKERS" OPEN DRIVE IN INDUSTRIAL STATES

BIG BIZ NEVER HAD IT SO GOOD

THE "BIG SMEAR" TECHNIQUE

MORE ANTI-UNION CAMPAIGNS

WAGE LAW CAN EASE POVERTY'S TOLL

IKE'S ECONOMIC MESSAGE DODGES ISSUES

SOARING COSTS OVERSHADOW WAGE HIKES

From the headlines it's not hard to realize how well the editors of union publications really cover the ground.

Management Fails to Take Direct Stand on Vital Issues

Now — what did management do through its employe publications during the first three months of 1957? Was anything done to counteract specific union propaganda?

In a survey of employe publications of the 50 largest corporations in the U. S. (listed by *Fortune* magazine as to net sales) to determine what corporations have done in the first quarter of 1957 in their employe publications to present management's viewpoint to employes on the five controversial issues, it was found that:

A. Only three of the 37 corporations responding to our survey took a direct stand on one or more of the five controversial subjects.

(a) All three companies took a direct stand on the Price-Wage Spiral.

(b) One of the three companies expressed an opinion on two other subjects—the Right-To-Work Laws and Corporate Profits.

(c) Only a fraction of one percent of the space available in company publications was used to present discussions and opinions on the five controversial subjects.

B. However, of 34 corporations which did not take a direct stand on any of the controversial issues.

(a) Seven did present an informatory article on the subject of profits of their own companies through annual reports to employes, and

(b) One took a subtle approach on the Price-Wage Spiral by citing statistics of the National Industrial Conference Board and the Bureau of Labor Statistics. This approach does provide employes with some of the "economic facts of life."

C. Two volunteered information that controversial issues are discussed with supervisory employes at group meetings or through special publications hoping that some of the information would "filter" down to all employes. In all fairness, it must be assumed that other companies are promoting similar programs.

A Very Few Companies Do Effective Job

The fact remains, however, there were *only three* of the 37 companies which took a direct stand on one or more of the five controversial issues under consideration. Two of them had one hard-hitting editorial each in the three months. The other did *much* better.

One company expressed management's opinion on inflation or the Price-Wage Spiral under the heading:

INFLATION . . . OUR NUMBER 1 ENEMY

Management's viewpoint on this particular subject was that "out-of-bounds" government spending should be blamed for inflation.

Another company expressed management's viewpoint on the same subject under the headline:

STEEL PRICES DO NOT CAUSE INFLATION

The opinion expressed in the editorial was that no one union or segment of industry can stop inflation because "every new wage agreement that is signed in any major industry immediately becomes the floor upon which the next union pyramids its demands for a still higher wage."

The third company, doing the best "bang-up" job in the country today, was General Electric Co. This company says what it thinks, presents what it believes to be right, and dosen't pull any punches.

Here are some examples of what GE has done within recent months.

First, on the Right-To-Work Laws —the headline reads

"RIGHT TO WORK" LAW PASSES IN INDIANA—SIGN OF THE TIMES

Part of the text reads:

"Last week Indiana became the 18th state to enact a "right-to-work"

law. The Indiana legislation — like other "right-to-work" bills—protects the individual's rights to join or not join a union, as he sees fit, without the threat of losing his job or being unable to get a job."

Here's another provocative article. It's a takeoff on "Right-To-Work" laws but a lot more forceful than the one we've just reviewed.

Under a headline

IS THIS WORSE . . . THAN THIS—THE "YELLOW DOG" IN REVERSE

Management presents a dramatic picture in the form of two cartoons. Both cartoons show a personnel office of a company. Out of both offices comes a man who is quite downhearted. One cartoon depicts the time as in the early part of the century. The other depicts the time as now. On the wall of the early 19th century office is a notice . . .

NO UNION MEMBERS HIRED HERE

Outside the door of today's office is a union man and a sign which says,

YOU MUST JOIN A UNION TO WORK HERE

The copy is interesting. It's thought provoking. It says, "Years ago union officials labeled it a 'yellow dog' contract. At that time a man had to guarantee he didn't belong to a union—and wouldn't join a union—in order to *get* or *hold* a job. It was a bad practice! So bad in fact that it has since been declared illegal.

"But was the 'yellow dog' more vicious than the union shop which some people are trying to force on free working Americans these days? The union shop is nothing but the 'yellow dog' contract in reverse."

Now, how about this one on Price-Wage Spiral? This article also is illustrated by artwork. A group of coins is pictured representing the amount of money that was added to plant employes paychecks under a "cost-of-living" clause in the labor contract. It's headline is

CONGRATULATIONS . . . BUT

Here's the written material which once again, like the other articles is thought provoking.

"23,000 Schenectady General Electric employes received another cost-of-living pay boost this week.

"So congratulations! But remember, cost of living adjustments just keep your pay dollar from shrinking. Real pay raises come only from increased production, greater efficiency, lower costs."

GE is doing a wonderful job—the best in the country.

Employes Like to Hear Each Side

Those who say such a program would hurt their company might consider that GE apparently hasn't suffered too much in their labor relations. From what GE tells us, the unions respect the company.

Koppers has a long way to go before catching up with GE's activity in this area of communications. The company has mapped a program which calls for frank discussions this year of 31 different controversial issues, including the five discussed here. To supplement the employe publication program a handbook is being prepared on these 31 controversial issues setting forth the union's position and Koppers management position. Going one step further, these will explain "why" the company has taken its position. In some cases, management goes along with union.

One might ask, "What has been experienced since the program started? Has it caused any friction between Koppers and its employe unions since it was started two years ago?" The answer is a decided NO! Neither employes or their unions seem to have been incensed. There hasn't been one instance in labor negotiations where the subject has come up. In fact, a readership survey of employes indicated an overwhelming desire to read about management's viewpoints on controversial issues affecting labor and management. Over 90 percent of employes said they read the information printed on controversial issues. 18 percent of the employes said they usually agreed with management's viewpoint. Over 70 percent said they liked to read about both sides of an issue and then make up their own minds. What is difficult to understand is why only a few management's have taken steps in their communications program to be sure that their point of view on any controversial issue affecting both labor and industry is put directly before their own workers.

Many companies have their own publications and in many ways they are good ones. Employes read them and believe them. Why aren't they used to present *logically* and *forcefully*, management's ideas on important subjects? Is there no faith that most employes—if given both sides of a question—will reach sensible conclusions? Actually, many companies just haven't given employes a chance to hear both sides of the question and it's time they started to do it.

Better Understanding from Vigorous Discussions

Management just has not been counteracting specific union propaganda aimed at influencing employes on realistic "breadbasket" subjects which union leaders use as levers to promote national social legislation.

Management seems to want to duck a fight. The unions look for one. During the past 2½ years, on the few occasions when management has sought to use its private communications media in an attempt to influence national, state, and local legislations, it has often done the job so timidly, or in so involved a fashion, that its employes must often have been left asking "why" to a lot of questions which should have been faced squarely and simply.

Some constructive action was taken by management during this period resulting in a better understanding of an individual company's economic problem during a particularly trying labor-management negotiation — usually in the form of letters to employes, explaining the company's position. Why only these?

It is quite obvious that an employe, in order to formulate his opinion on an issue needs forceful discussion from both sides. Labor leaders would be stripped of much of their propaganda potency if management would shout, not whisper.

Plan of Action Requires Important Decisions

There is only one conclusion: It's about time management took another look at what its employe publications are for: at what they can do; and, at what questions should be raised in them. What easier, more logical, or more direct way is there of opening the door to better understanding than using company employe publications as the key?

After all, if management really believes that its economic system is good for America, why should it be shy about telling its own people the whys and wherefores? If management has a good product, it is never bashful about advertising it to the world. What is different about telling the virtues of its beliefs?

How does management go about doing this and what should its plan of action be? A number of decisions are involved.

First, *Deciding To Do It*—A good many managements will do a lot of "hemming and hawing" over this one, which comes first of all. Some will bog down at this point. There isn't any question that management can do it if they want to; they just haven't wanted to enough up to now.

Second, *Being Willing to Let Company Publication Editors Write The Material As Simply and Understandably As The Unions Are Doing It*—A good many companies will "committee" this one to death, between company economists, the legal department, the finance department, and, last but not least, the president's office. It is perfectly amazing how persuasive many businessmen can be on this kind of subject until they either try to write it out or discuss it in a prepared speech.

Third, *Providing The Necessary Editorial Caliber* — This important kind of thinking and writing calls for editorial skill far beyond the "picnic and bowling team" kind of writing done in many employe publications today. And, last but not least

Fourth, *Being Willing To Face Up To The Fact That Material Of This Kind Must Be Presented Forcibly And With Conviction*—It has been shown that labor does not hesitate to present a one-sided argument on many economic and political problems. Management may feel that a more objective picture that presents both sides is fairer and perhaps more convincing. Maybe, but that doesn't mean it shouldn't present its own arguments and present them with spirit. Most people, including workers, respect honest enthusiasm. And many like a good battle, even if it's only a battle of words and ideas.

Once the decision has been made to fight this battle with both hands, here are a few further suggestions that will help:

1. Charge the editor with making this job part of his editorial plan. After he gets over the first shock, this will be easy. Most editors are crusaders at heart, and have been waiting for an opportunity of really doing the job they expected to do when first hired.

2. Do everything possible to help him get at the facts, but let him see to the writing and editorial work. Remember he is a professional, or at least he should be. He is being paid to know his publication audience and how to write for them.

3. See that he gets every union publication reaching the employes, as well as the official national organ of the AFL-CIO. He needs to know what he's up against.

4. Send him to talk to key people in national organizations that are working to tell the story of free enterprise. He needs a working knowledge—a personal point of reference. He needs to know what these organizations are doing, what they have done, and what they are publishing. Their doors will be open. Among them are the U. S. Chamber of Commerce, The National Association of Manufacturers, The National Industrial Conference Board, and many others.

5. Overlook no means of carrying management's message to employes. Use other in-plant communications systems—such as the reading rack, bulletin boards, even letters direct from the company president—to reach all employes, not just supervisors, when the issues are vital enough to justify it.

There is nothing particularly complicated about going into this battle with both hands. The facts are available; they just are not being used. The employe publications are available too; they just are not being used either. The unions are already in the ring. The question is whether management will get in the ring too or lose the battle for the minds of its employes on an editorial TKO.

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Underground Drilling Machines

Three well qualified men discuss the use and maintenance of rock drills, and the value of drill performance data assembled by mine operators in advancing rock drill design

Rock Drills—The Prime Tools of Mining

By E. B. (TED) OLDS
Mine Superintendent
The Bunker Hill Co.

IN the year 52 A. D., during the reign of Emperor Claudius, the 3½-mile tunnel that drained Lake Fucino in the Italian Province of Aquilo was completed. It is said that 30,000 men worked for eleven years to complete this 6 by 10-ft bore. One hundred men could do it now in a few months and under living conditions far better than those enjoyed by Emperor Claudius, himself. Only a few years ago, less than 100 men, using modern tools and equipment, drove an equivalent portion of the six-mile, 10 by 11-ft Carlton drainage tunnel at Cripple Creek, Colorado, in 361 days. And, today, a midwest zinc miner is producing 194 tons per drill shift.

The rock drill is, without question, one of the greatest single contributors to this remarkable progress.

The rock drill industry is about 100 years old and yet our present day drills have not changed in basic operating principle from the John George Leyner patents of nearly 60 years ago. The greatest changes during this period have been in the drill mountings and have made the drill a more continuous operating machine.

The versatile jackhammer mounted on an air-feed leg is continuing to gain popularity in stoping, block cave undercutting, long hole prospecting, and in driving headings. One operator is considering telescopic feed jacklegs to drive large haulage drifts. He plans building a platform on an old set of muck car trucks to enable the miners to reach the back holes without building a staging for each round. This setup would replace expensive jumbo rigs and heavy drifters. The Bunker Hill Co. is using telescopic legs in horizontal cut and fill stopes and have found they not only make the drilling easier, but provide a much more even back in the stope. Three-inch bore jacklegs will soon be on the market.

A large copper mine is successfully putting new guides on drifter shells. First, they take off one inch of the old guides with a milling machine, and a one by one-in. aluminum alloy bar, designated as 2024-T-4, is welded on electrically. The new guides are then machined for clearance. The cost of putting the new guides on is about $80 as compared to $250 for a new shell.

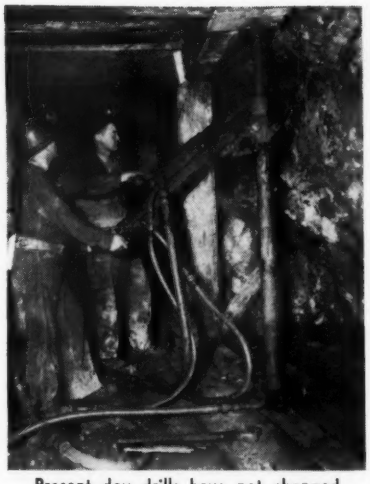
The 194 tons of muck broken per drill shift mentioned before is done with one man, operating a standard two-machine jumbo with a 12-ft boom, in ground which has an average face height of 14 ft. The drills are 3½-in. drifters. 1¼-in. round drill steel ranging in length from 10 to 13 ft. are used with 2⅜-in. carbide 4-wing bits.

A Colorado operator reports changing the 4-ft feed shells on two boom heading jumbos to 10-ft shells. These long feeds are screw type, not chain feed. Some have been in service for nine months without any maintenance cost on the shell or feed mechanism. Preliminary time studies have shown 20 percent reduction in drilling cycle time is possible by eliminating one steel change.

Maintenance Is High

Most operators feel their rock drill maintenance is too high. A Utah mine has cut it's jackleg maintenance materially by covering the drill with a heavy canvas bag when it is not in use. Many drills were coming to the shop inoperative only because they were too full of dirt to run. Most of the dirt entered the machines through the chuck, the exhaust ports, or through the air connection. Due to careless handling by the workers when moving the machines to and from the face. Occasionally, drills were covered by muck when left too close to the blast. At times it has seemed almost impossible to impress miners with the importance of proper machine care and the high cost of abuse. The canvas sacks seem to have certain psychological advantages resulting in a better attitude of the operator toward his machine. Somehow the use of the bag has imparted a value to the machine that the miners previously were not willing to accept.

At this same property the average life of some of the major jackleg parts before replacement is:



Present day drills have not changed in basic operating principles from the John George Leyner patents of nearly 60 years ago

Parts	Footage Drilled
Chuck	5,081
Hammer	11,008
Rifle nut	6,116
Steel holder	16,513
Chuck end	18,348
Feed Piston	18,348
Feed cylinder	33,026

Because of careful handling these parts have much longer life on many machines than is suggested by the recorded averages. On the other hand, poor lubrication tends to cut the normal parts life to a fraction of that attained with conscientious care and handling.

Bunker Hill has started packaging rock drill oil in one-quart cans in hopes of obtaining a more dirt and dust-free oil in the line oiler. The cans are the type in which outboard motor oil is packaged, and are reused. It is hoped the added cost of the quart size cans will be saved by eliminating much of the spillage and waste.

When Should a Rock Drill Be Scrapped?

The cost of rock drills if purchased by the part is surprisingly high. For example, a three-in. drifter that costs $1,385, if purchased by the part would cost $1,836 or 33 percent more. A rotator that costs $1,050 is $1,419 by the part, or 35 percent more. A jackhammer mounted on a telescopic air feed leg costs $865. Buying it by the parts, it would cost $1,349 or 56 percent more.

This brings up the important and unanswered question; "When should a rock drill be scrapped?"

It certainly must be conceded that as long as a rock drill is at the face it must be in first-class shape. It is not, for instance, like an old automobile that can be "babied" along at 35 miles an hour to get a few more miles out of it.

Some operators feel 60,000 to 70,000 ft of drilling is the economical life of a rock drill. The author used to favor the thinking that when the cylinder was worn out, it was time to scrap the drill. However, that is not true, at least at Bunker Hill. To quote one of the currently "hard pressed" lead-zinc operators on this subject; "We are not in full agreement among ourselves on this question. Under our conditions, it is my opinion that a rock drill need not be scrapped until the model is obsolete. We have a highly abrasive gangue and it acts as a very effective grinding compound on all wearing surfaces. For this reason, we have some machine parts which require comparatively frequent replacement. Hence, it is difficult to say that a machine is worn out at any given time when most of the essential parts may vary from new to worn out. Although some will disagree as to its merit, we have our cylinders brought back to standard by chrome-plating."

The versatile jackhammer mounted on an air-feed leg is continuing to gain popularity

The American Mining Congress underground drilling committee feels there is a great deal to be gained by an exchange of information within the industry.

A questionnaire has been sent to many operators. If you receive this questionnaire, please make a sincere effort to fill it out. When the information is catalogued and published, most people probably will find some practice that will make their operation more efficient.

Effect of Data Records On Design of Rock Drills

By JACOB E. FEUCHT

Manager, Engineering Department
Cleveland Rock Drill Plant
Le Roi Division
Westinghouse Air Brake Co.

THE highly controversial question, "When should a rock drill be scrapped?" on which E. B. Olds commented, may be clarified considerably by the data accumulated by the questionnaire the underground drilling committee is sending to operators. But only if the information that the operators submit is factual and accurate. Most operators are today in a much better position to furnish this type of information, with a much

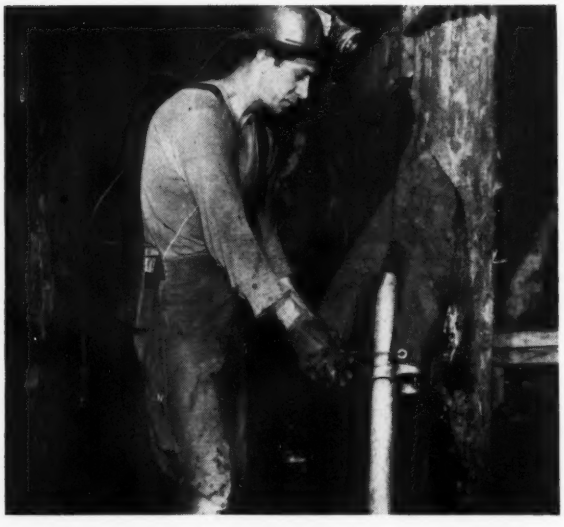
higher degree of accuracy, than in the recent past.

Methods used to compile and record data regarding drill performance and maintenance varies widely with each mine operator, and the thoroughness usually varies with the size of the mine. There is no standard of comparison, but to do an effective cost control job the data that must be accumulated on these records to properly evaluate the performance of the drill is as follows; drill serial number, section or miner using drill, date of return to shop, reason sent to shop, drill footage data, parts and/or cost of repair parts, drill doctor's remarks, and date of return to mine.

Accurate Drill Records Pay Off

Like in all industry, cost reduction is a vital element, and it is to this end, that records of this nature can highlight sore spots so they can be singled out for proper analysis; first by the mine operator for corrective measures due to obvious misuse of equipment, and secondly by cooperative efforts between the mine operator and the equipment manufacturer.

The importance of accurate drilling



It cannot be overstressed that foreign material must not enter the internal parts of the drill. The miner shown here is covering his machine at the end of the shift with a canvas bag—a practice well worth the time and effort

cost records cannot be stressed too highly, but if any benefits are to be reaped from them, conscientious and capable personnel must detect the storm warnings early and take corrective measures promptly.

Many of the recent improvements made to reduce the maintenance cost on drilling equipment was originated as a result of action taken from systems of this type. The problem of evaluating results of modifications made to combat adverse wear conditions is simplified because the prior performance records act as a basis of comparison when redesigned and improved parts are field tested. To improve maintenance costs on drilling equipment, the most common methods used are; utilizing improved materials and heat treatment, channeling oil to wear surfaces, shielding wear surfaces from abrasive cuttings, and modifying design to utilize less expensive construction.

Duplicating mining conditions for developing improvements at the factory, while not impossible, is at best very difficult and results invariably require confirming field tests under actual mining conditions.

The most frequent cause of high maintenance cost and lack of drill speed is failure to always use an oiler, filled with the recommended grade of rock drill oil, in connection with the drill

Poor Treatment Costs Money

All too frequently, operating troubles and excessive repair costs are strictly the result of improper preventive maintenance and operating procedures.

A line oiler that feeds a constant flow of oil into the air stream should always be used in connection with air tools and should be filled with a recommended grade of rock drill oil. Omission of this vital procedure, although always stressed in operating manuals, is one of the most frequent causes of high maintenance cost and loss of drilling speed. Probably the condition that rates second is carelessness in permitting foreign material to enter the internal parts of the drill through the air connection. Drillers should always blow the air hose for a few seconds prior to attaching it to the drill.

One of the most frequent causes of trouble lies in the use of chucks worn beyond an acceptable limit. Most rock drill parts will continue to function when they are worn beyond acceptable limits and the chief result will be loss of efficiency. The worn chuck, however, is malignant and not only loses efficiency, but sets out on a course of destruction to other parts. A worn chuck allows the drill steel to become misaligned allowing the piston to strike the edge of the drill rod, thus tending to chip and spall both the face of the drill rod and piston. A sloppy chuck allows excessive air leakage and a consequential loss of blowing power. This condition also allows misalignment of the water needle with the drill rod which causes battering of the tube and cuts off flushing water flow.

To enumerate all of the practices that cause high maintenance, is a very lengthy subject and it is only necessary here to indicate a few of them for the purpose of portraying how, with the use of an adequate drill maintenance cost record system, preventive measures can be applied early to keep costs low.

Recent developments such as replaceable drill chuck bushings, shielding of air and oil cylinder bearing bushings, material changes in most drill parts, redesigning parts to eliminate stress concentration points and channeling oil ladden air to major wear points, have all come about primarily due to the close cooperation between the mine operators and the manufacturers. They are particularly due to the fact that these weaknesses are pin-pointed by the records mine operators are keeping today, and that once redesigned parts are available, accurate field test data is readily made available for comparative results.

The problem of the economical point to scrap a drill will probably always remain a problem that will continue to be left to the discretion of mine operators, but decisions are much easier to make when accurate records of performance and maintenance costs are kept and weighed against newly developed modern drilling equipment that is currently available.

Research Objectives For Improvement of Rock Drills

By ROBERT L. SANDVIG
Research Engineer
Thor Power Tool Co.

E. B. OLDS makes a most significant statement of fact in pointing out that present day drills have not changed in basic operating principle for 60 years. Improvements in design details, manufacturing, and materials have been accomplished. However, when one considers the millions of man-hours spent by the most able rock drill engineers and designers, it is reasonable to conclude that the compressed air type percussion drill generally employed in underground drilling is essentially perfected.

Tungsten carbide insert bits made a very radical change in the application of the rock drill, because the 18-in. or 24-in. steel change was no longer dictated by dull bits. So now the 10-ft and 12-ft change mounting is rapidly becoming a must. That in turn dictates expensive boom type drill carriages in headings or flat bedded stopes where cycles demand more footage of holes to be drilled than the semi-hand-held airleg drills are capable of completing. To offset the cost of such equipment, completely powered hole positioning is employed to enable more drills to operate at the face than there are men employed in their operation. This multi-drill "jumbo" is a productive machine that will improve, but already special designs are required for special mining conditions. The questionnaire recommended by the American Mining Congress committee on underground drilling will be a valuable aid toward development of multi-drill jumbos for more widespread underground employment.

Reverse Flushing Results in Higher Efficiency

Cuttings flushing is, of course, accomplished by the flushing fluid, normally water underground. However, the rock drill is the source of the flushing stream in its course to the bit face, and there lies a field for improvement. "New York" backheads, sealed shanks, and reverse flow air flushing are significant advancements. Clearing rock cuttings away from the bit face the instant they are made will result in greater drilling speed and much greater bit life. Because the water hole in the drill steel has but three to five percent the cross-section of the hole being drilled, flushing fluid expanding into the drilled hole returns to surface so slowly that it does not have adequate velocity to remove the coarser particles. By reversing the flow of flushing fluid, cuttings can be removed through the hollow drill steel at a very substantial velocity. Air is judged to be most practical for the reverse flow flushing fluid, and will normally require a dust extractor to repurify the flushing stream of air. The disadvantage, however, of the dust extractor must be weighed against the advantages of faster drilling, less bit wear, and cleaner working environment.

Rotary-Percussion Drills Show Promise

Faster drilling is always a desirable objective, but to accomplish that, it is reasoned that additional energy must be applied to the rock other than percussion blows. High thrust rotary drilling is being used very successfully in coal mine roof bolting and in oil shale. In hard rock, high thrusts result in bit attrition almost proportional to rock attrition, so straight rotary drilling has little future in hard rock mining. However, taking moderate thrusts and superimposing percussive blows results in very large cuttings and spectacular drilling speeds. Bit attrition is reduced because the rock fails violently under the application of three forces, thrust, torque, and percussion. The higher penetration rate offsets the additional bit costs. This is rotary-percussion drilling, already quite advanced in Europe, and subject to much discussion in this country. Rotary percussion drills will necessarily be mounted on machines capable of stability with thrusts of 2000 to 6000 lb. Further, a universal rotary-percussion drill is very unlikely, but rather, it must be designed along with its associated rig for specific mining applications. This committee's questionnaire, cited before, will be a useful means for manufacturers to foresee their market before undertaking the design of a rotary percussion machine specifically committed to particular mining appli-

Extensive testing to establish the right proportions between thrust, torque, and blow for various rocks is another apparent research activity that will be associated with rotary-percussion drilling, or any other yet undefined drilling method which applies more energy to the rock. Interchange of such information stands to benefit the mine operator.

Applications of the conventional percussion drill have by no means been exhausted, and as tungsten carbide bit quality continues to improve, operations research at the mine and application research at the factory still have the foremost task of improving the underground drilling machine.

As bit quality continues to improve, operations research at the mine and application research at the factory still have the foremost task of improving the underground drilling machine

Continuous Mining in Strip Highwalls

By A. D. HENRY
General Superintendent-Strip Mines
The Powhatan Mining Co.

OPEN PIT or strip mining has been in progress since the turn of the century in Ohio and is now responsible for about two thirds of Ohio's annual coal production. Three eastern counties, Belmont, Harrison and Jefferson, contain large acreages of Pittsburgh or No. 8 coal. Much of this vein is located near the tops of the hills and is well located for surface mining. The seam is uniform in thickness, averaging about 56 in. and dips about 25 ft per mile to the southeast. While most of Ohio's coal production comes from the Pittsburgh vein, large quantities are also being strip-mined in other seams.

Overburden Exceeds Stripping Limit

In spite of the mammoth stripping shovels in use, most mines eventually reach a height where it is not economically possible to strip higher, and as a result tracts of coal under high cover, varying in size from a few to several hundred acres, remain unmined. Finished highwalls usually vary in heights from 60 to 100 ft, depending on the range and capacity of the equipment making the final cut. Much of this coal under high overburden was considered of little value until a few years ago as there was no suitable way of recovering it. In 1951 and 1952 a few companies started auger mining some of these areas, and while it can be mined at a very low cost, it is also wasteful of the coal reserves. Once the perimeter of a block of deep coal is auger mined, it is not possible to recover the remainder by any other method.

This waste and loss of deep coal reserves prompted officials of The Powhatan Mining Co. to conduct experiments with continuous mining equipment under highwalls that had been stripped to about 80 ft of cover at their Betsy Mine in Jefferson County near Bloomingdale, Ohio. This mine operates in the Pittsburgh or No. 8 coal, which averages 56 in. in thickness. There are about 1000 acres of this deep coal remaining on the Betsy property. Stripping had been completed on most of it eight to ten years ago, and the pits contained large quantities of highwall slough and water.

Pit Prepared for Continuous Mining

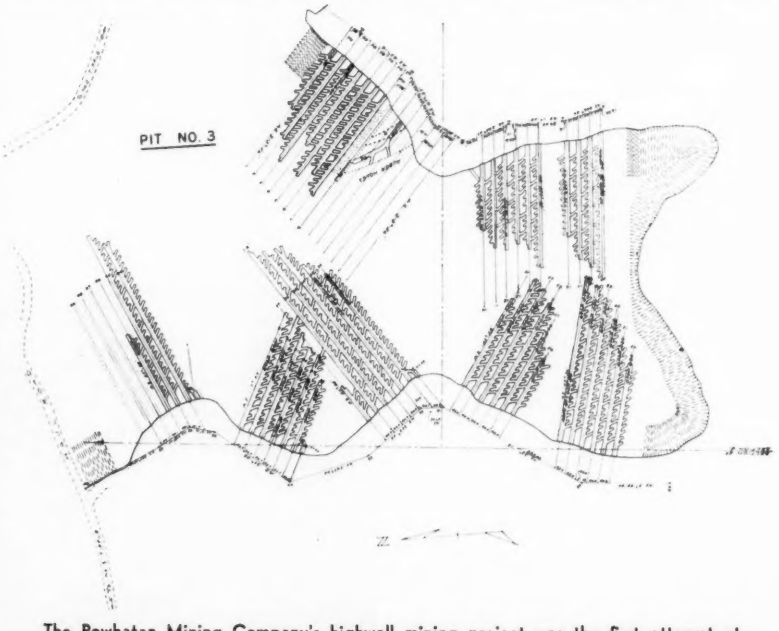
Preparation of pits for highwall mining after stripping had been finished for a number of years was a difficult task. Drains had to be opened with bulldozers and a 3½ cu yd diesel shovel, so that pits were relatively free of high water. The shovel was then put to casting the slough from the toe of the highwall to the spoil side, and more often than not it had to be handled several times. A bulldozer performed the final clean-up and every effort was made to have the cleaned pit measure about 70 ft wide when finished and have it as dry as possible. The pit bottom is a hard gray shale and slate which usually makes a satisfactory haul road. Even small accumulations of water in the pit prove troublesome, especially in cold weather, and intermittent pumping is required.

Preparing the pit and highwall for continuous mining during the final stripping and mining cut can be done with practically no added cost. If possible, the highwall should be drilled and shot vertically so as to eliminate dangerous overhangs. The wall should be sloped and scaled free of loose material. Pit bottoms can be bulldozed free of pit cleanings and drains left open. It is desirable to have the continuous mining operation follow the final strip coal loading as closely as possible so as to take advantage of the clean pit and unweathered highwall.

Boring-type Machine Selected

The roof in the Pittsburgh coal is notoriously bad and the experiments referred to above were conducted in the summer of 1955 to determine the proper type of continuous mining machine to use and how best to control the roof. A small pit area was cleaned out and rooms were driven with both ripper type and boring type machines.

The boring type machine was equipped with hitch hole cutters that cut a six-in. swath directly under the roof to a depth of about 18 in. The roof was supported by placing one end of a 4 in. by 4 in. by 15 ft, 6 in. H-beam in this opening and supporting the other end with a post and wedge cap. This type continuous mining machine would advance a 9 ft, 6 in. cut 20 ft deep, back up and take an additional 6 ft 6 in. widening cut to 16 ft, at which time the H-beams were



The Powhatan Mining Company's highwall mining project was the first attempt at this type of operation in Ohio and offered a real challenge to all persons connected with it

set on four-ft centers. During the experiment some of the roof was left unsupported and did not stand for any appreciable time. Another area was roof bolted with various lengths of bolts. Satisfactory torque was not obtained until a 96-in. bolt was anchored in what is locally called the "bastard limestone." It was considered necessary to develop the 16-ft room in order to maneuver the boring type machine in and out of side cuts and breakthroughs. The boring type unit produced 3.24 tpm of operation in this test when coal was conveyed with an extensible belt. Under similar conditions the ripper type machine put out 1.12 tpm. Roof action indicated that blasting in the final stripping cut weakened the top by varying degrees to a depth of about 40 ft. Extra H-beams and posts were used under this disturbed area. Few serious roof falls resulted from this source. As a result of these experiments, it was decided to proceed with the installation of a boring type machine along with the necessary auxiliary equipment.

Cost of Complete Unit—$250,000

As with any new untried venture the problem of building and perfecting the complete unit was a major task. A 30-in. extensible belt, with 1000 ft of belt, conveys the coal from the continuous mining machine to the elevating conveyor in the pit. A 20-ft bridge conveyor attached to the extensible belt tail piece gives the continuous mining machine enough flexibility to cut breakthroughs and rib cuts. A portable elevating conveyor, which was designed and built in our own shop, conveys the coal from the belt head to the coal haulers. A heavily re-enforced arched steel canopy is placed next to the highwall at the pit mouth to deflect any falling rock or debris from men and equipment. Lack of purchased power facilities necessitated the use of a trailer mounted, diesel powered 300-kw d-c generator plant. Additional items are:

OPERATING DATA

	1956	1957
Tonnage produced	89,581	140,657
Tons per shift	207.1	300.0
Tons per man-shift	21.1	29.5
Tons per ft of advance—wide work	4.20	4.82
Average depth of rooms—ft	338	400
Acres mined	21.07	26.63
Recovery per acre—tons	4,249	5,282
Face cost—labor only—ton	$1.169	$0.922
Bit cost—per ton	$0.076	$0.056
Roof bolts set per shift	38	43
Posts set per shift	43	42

1—Small roof bolting drill
2—Shuttle Cars
1—Set power cables and distribution house
1—Portable mine fan
1—High pressure pump and water system
1—Tank truck for water haulage
1—Combination foreman's office, lamp and rest house
1—Supply house
200—4-in. by 4-in. by 15 ft 6 in. steel H-beams

It should be remembered that all of this equipment must be kept portable and is either mounted on rubber-tired trailers or steel sleds. A bulldozer is used for moving and positioning it in the pit.

Much of this equipment was built and assembled in our own shop, some of it came from some of our company's other underground mines. However, the continuous mining machine and extensible belt were bought new. Cost of the machine is about $100,000, the extensible belt is $85,000. The remaining items amounted to approximately $65,000, thereby providing sufficient equipment to load coal into transportation facilities for a total of $250,000. Had all of the equipment been purchased new, the cost would total at least $300,000. The company is mining this deep coal and combining it with their strip coal production and therefore did not have to buy extra haulage units nor tippling facilities. Three 35-ton tractor-trailer units and two drivers are used to haul the coal a distance of four miles.

Sufficient coal reserves should be provided to depreciate the greater share of this type capital investment of $250,000 over a period of about eight years. In order to maintain a well balanced two-shift operation, the unit should produce approximately 12,500 tons per month or 150,000 tons per year. On this basis, reserves of about 1,200,000 tons would provide an eight-year depreciation schedule of $0.21 per ton. Replacement of some of these items can be expensed as they wear out.

Mining Plan Follows License Requirements

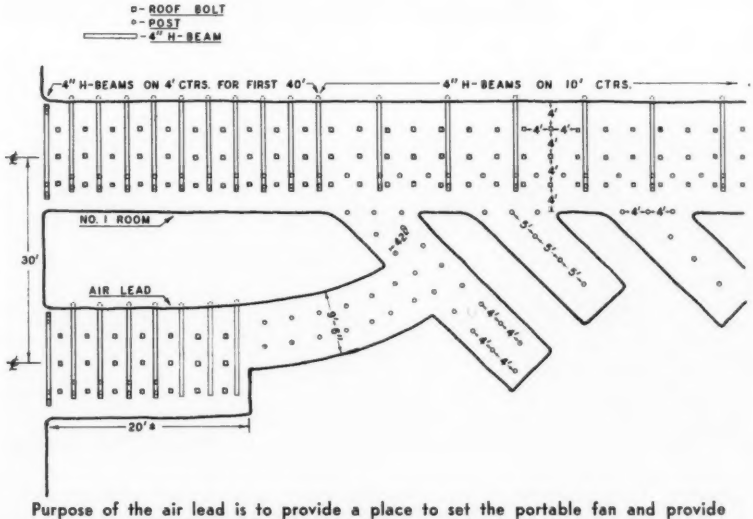
A detailed mining plan of the pit area, room panels and room projections is provided by the engineering department. The combination roof bolting pattern and roof support plan now in use is the one best suited to our conditions. The engineers set and advance sights as rooms advance, measure all projections and record tonnage mined. The mine map of Pit No. 3 represents a typical area and shows the six room panels separated by 100-ft blocks of solid coal, all of which is required by a license issued by the State of Ohio's Division of Mines. All of this mapping and field work requires about two hours of the engineering corps time each day.

The entire operation is conducted in strict compliance with licenses issued by the Ohio Division of Mines and under the supervision of the U. S. Bureau of Mines. We have enjoyed the utmost in courtesy and co-operation from all personnel connected with both of these agencies. The highwall mining project was the first attempt at this type of operation in Ohio and offered a real challenge to all persons connected with it. Many changes have been made since the start in January, 1956, and it has required a year and a half of constant changes and improvements to reach the present high rate of efficiency and production.

Pit Width Determines Equipment Location

Locating and positioning of equipment in the pit area is largely controlled by the pit width. As stated previously, wide, dry pits are desirable but not always available by any means. Movement of trucks and

PLAN OF AIR LEAD AND ROOM NECK



Purpose of the air lead is to provide a place to set the portable fan and provide air in the regular room. Note the method of roof control

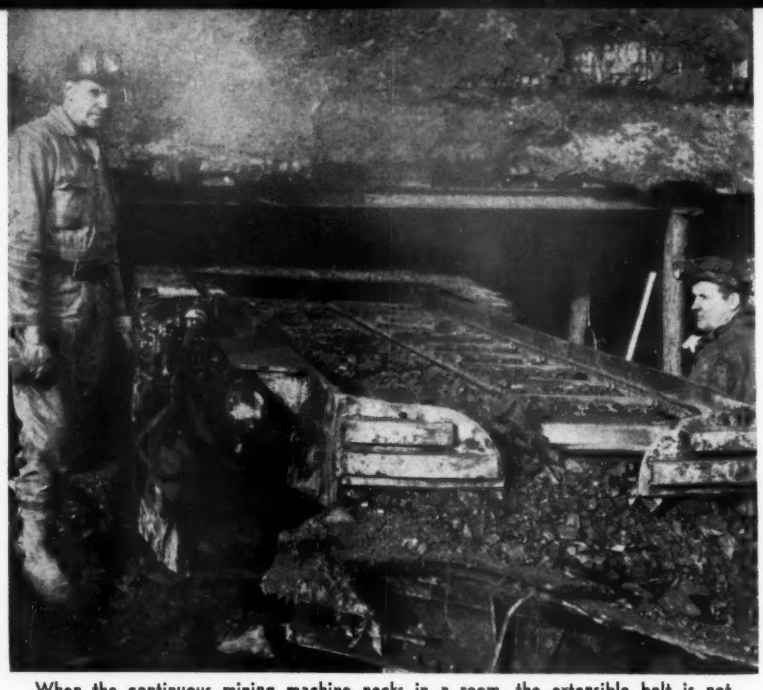
equipment and water seepage from the highwalls and spoil banks keep the working place area muddy most of the time, in spite of good drains and frequent pumping. The foreman's office, supply house, spare canopy, shuttle cars, spare belting, etc., are placed out of the way of the trucks yet handy for use. The generator plant, power cable distribution house, high pressure water pump and tank are kept within 100 ft of the active room, but on the opposite side of the area occupied and used by the trucks and elevating conveyor.

Sequence of Operation

Before No. 1 room of a panel is started, an air lead is driven in, usually to a depth of 30 to 40 ft, on 30-ft centers with the centerline of the new room. The lead is driven straight in full width for about 20 ft, then angled to the left with a single lift to a point that will intersect the projected room about 35 to 40 ft in from the face of the highwall. The purpose of this air lead is to provide a place to set the portable fan and provide air in the regular room, thereby extending the depth slightly to which it can be driven and still comply with the law pertaining to air.

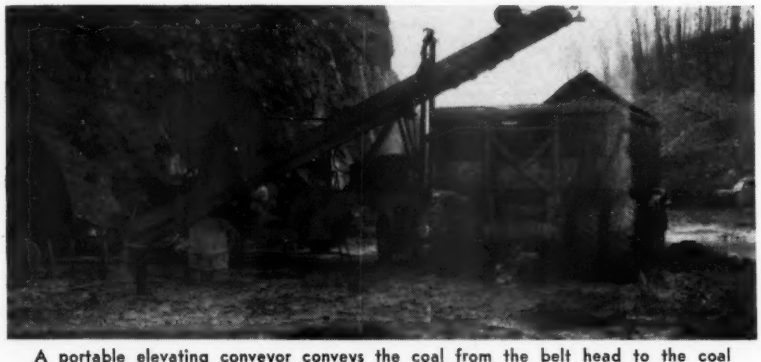
When the continuous mining machine necks in a room, the extensible belt is not set up until the room has been advanced and widened under the highwall a distance of about 30 ft. During this time it loads directly onto the elevating conveyor or into shuttle cars if pit room is too limited. Once the machine has made its initial 9½-ft cut on the left side to a depth of 20 or 25 ft, it backs out and moves over preparatory to making the widening lift of 6½ft. As the machine moves out, the roof bolters move in and set a pattern of 96-in. roof bolts on four-ft centers. As the widening cut progresses, the top is caught as soon as possible. This is done by setting steel H-beams on about two to four-ft centers, one end in the left hand rib hitch hole cut by the continuous mining machine, and the other end on posts. (It is seldom necessary to set H-beams on these close centers to a depth greater than 30 or 40 ft.) While the boring type machine drives the widening cut up even with the initial cut, the roof bolters have finished bolting and moved out. The machine, can then drive another 20-ft lift in the left lift after having set up the extensible belt between it and the elevating conveyor. During this same time, the timberman and bolters are working in the widening cut. Once the room is necked in, full width, beyond the tender roof area affected by final strip cut blasting to a point beyond the air lead, the fan can be set, the extensible belt and canopy are in place and the roof is well supported.

After the air-lead and No. 1 room



When the continuous mining machine necks in a room, the extensible belt is not set up until the room has been advanced and widened under the highwall to a distance of about 30 ft. During this time it loads directly onto the elevating conveyor or into shuttle cars if pit room is too limited

The roof in the Pittsburgh coal is notoriously bad and is supported with H-beams and roof bolts



A portable elevating conveyor conveys the coal from the belt head to the coal haulers. Three 35-ton tractor-trailer units are used to haul the coal a distance of four miles to the tipple

of a panel have been driven up, each succeeding room is necked in as previously described. As this room is driven up, every third rib-cut is holed into the previously finished room, which serves as an airway, supplyway and escapeway. No timbers or roof bolts are removed from any room as long as it is used as an escapeway.

Mining Cycle Allows High Production

Creating and maintaining the three-stage mining cycle contributes greatly to high production and varies somewhat from the necking in process just described. The boring type machine is advanced about 22 ft on the left side. (During this time the bolter is setting one row of bolts in the previous widening lift No. 3 in the neck.) The continuous mining machine is then retracted and the bolting machine moves into lift No. 1. The continuous mining machine then advances into the right hand pillar for a distance of 26 ft, making lift No. 2. It is then retracted and advances the right side of the room (lift No. 3). While this is being done, the timbermen set posts in lift No. 2. Upon completion of lift No. 3, the machine is maneuvered to the left side of the room and the mining cycle is started once more.

The law limits the depth of a room to 100 ft beyond air and an escapeway, thus about four rib cuts could be made after passing the air lead before cutting a breakthrough. However, we normally hole through every third rib cut, which provides an airway and escapeway about every 60 ft. Plans have been made and additional equipment purchased at our Betsy operation to work two complete units in parallel. While the mine is not yet operating these two units simultaneously, it has gained greatly in operating efficiency of the one working unit as a result of having the other as stand-by equipment. By having a second continuous mining machine, the men can drive the first and second rooms of a panel up alternately and thereby gain the maximum depth of both rooms and still maintain an escapeway. During 1957, 73 rooms were mined and averaged 400 ft in depth, the deepest room being 714 ft.

The mine produces coal on the daylight and afternoon shifts, the third shift is used for maintenance. Each of the production crews alternate shifts week about and consist of the following personnel:

1—Certified mine foreman
1—Continuous miner operator
1—Tail piece operator
2—Roof bolters
1—Timberman
1—Mechanic

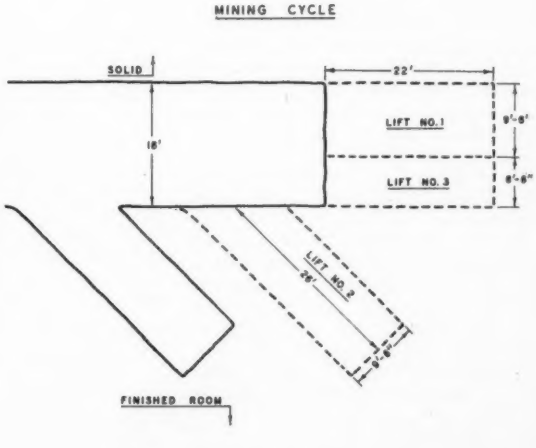
A utility man keeps posts, roof bolts and supplies handy to the room neck, fuels the generator engines and keeps water on hand for the high pressure pump. Two recovery men work the daylight shift. All H-beams and about 50 percent of all roof bolts set are recovered; handling of these materials is done with a shuttle car. Two second class mechanics grease and maintain the equipment on the midnight shift. Total personnel, including the two foremen, add up to 19 men.

Strip pit cleaned up for highwall mining. It is desirable to have the continuous mining operation follow the final strip coal loading as closely as possible so as to take advantage of the clean pit and unweathered highwall

Initial Difficulties Overcome

A brief review of our experience with this operation reveals many changes in the use of equipment, radical changes in design of certain components of the unit and alteration of the mining plan. During the first year of operation there were prolonged periods of time when the success of the venture was very much in doubt. The first coal was mined on January 30, 1956, under very adverse conditions; experienced underground miners and equipment were exposed to very cold weather which resulted in a large labor turn-over, frequent breakdowns and poor over-all efficiency. Some improvement was noted during warm weather, but as a whole the success of the venture was not assured, by any means, at the end of the year.

During 1957 many improvements were made. Crews were better organized and only the best men were retained. Local management designed and built the present elevating conveyor which contained a large power driven belt reel. Use of the belt reel permits parting the belt at the tailpiece of the extensible belt when a room is completed and winding it all up in a few minutes time instead of taking it off 100 ft at a time at the belt head. This permits extracting the fabrication and miner in short order. This item alone has increased shift production by at least 75 tons. Use of a small, highly portable roof bolting machine and good men to operate it is another most important item. Having stand-by equipment, especially the spare continuous mining machine, which is subjected to hard and continuous service, has increased efficiency greatly. All of these changes and improvements have resulted in a low cost operation and an increase in tons per shift. Results for the last five months of 1957 and thus far this year are much better than for 1957 as a whole. At present the operation is producing an average of 360 tons per eight-hr shift, with a face labor cost of $0.70 per ton, 31 tons per man shift and a $0.055 bit cost.



As a room is driven up, every third rib-cut is holed into the previously finished room, which serves as an airway, supplyway and escapeway. No timbers or roof bolts are removed from any room as long as it is used as an escapeway

UF_4 PRODUCTION IN URANIUM MILLS

Eliminates yellow cake precipitation, drying and shipment
Redissolving yellow cake not necessary
No HNO_3 used or H_2 gas reduction needed
Over-all savings possible

By RAY S. LONG, DAVID A. ELLIS, and JAMES E. MAGNER

Research Dept., Western Division
The Dow Chemical Co.

THE production of nuclear-reactor-grade products by uranium mills instead of crude yellow cake may be advantageous. In order to use uranium in reactors or in isotope separation plants, it is necessary that an extremely high degree of purity be obtained. However, the purity requirements are no greater than exist today for certain contaminants in more commonly encountered metals. At present, uranium for both metal and UF_6 production goes through UF_4. Since UF_4 is the current focal point for both, it would appear to be the most logical product.

Once reactor grade UF_4 is made, metal production is possible at the mill site. In this way, a material suitable for nuclear reactors can then be available for sale by the mill to a free market.

This article will discuss the current purification process and the proposed, integrated process. Included in the discussion are:

1. An outline of the current practice which involves purification of a mill concentrate at a separate site,
2. A proposed alternative plan in which recovery and purification of the uranium could be accomplished at the mill, and
3. A comparison of the processes showing some of the advantages to the uranium industry and to the United States Atomic Energy Commission which might be gained by employing the integrated process.

The Western Division of The Dow Chemical Co. under AEC Raw Materials Division contract has been studying this problem for the last 18 months. Several possible processes for making reactor-grade products have been developed on the laboratory scale for use either in new mills or in mills now in operation. Other AEC contractors now working on this problem of integrating feed materials with raw materials include: Mallinckrodt Chemical Co., Oak Ridge National Laboratory, and U. S. A. E. C. Raw Materials Laboratory operated by the National Lead Company and the U. S. Bureau of Mines.

Current Process Described

In Figure 1 the operations currently used, and the proposed alternative methods are shown.

In the present process, the steps which are commonly done at the mill consist of grinding, leaching, IX or SX, and culminate in the precipitation of a yellow cake product. At present, the ion exchange, solvent extraction and sodium carbonate-caustic precipitation processes in use in this country and abroad turn out relatively crude uranium oxide products containing about 75 percent U_3O_8 with varying amounts of impurities such as Na, Fe, V, Mo, etc. A large number of both metallic and nonmetallic impurities, although present in amounts under one percent, still greatly exceed the specifications for nuclear feed materials. Hence, further processing is required. This processing is now done in the AEC's feed materials refineries.

The yellow cake from each mill is dried, packaged and shipped to the feed materials plant where it is then inventoried, blended and sampled. Considerable facilities are involved in the sampling operation. The yellow cake is dissolved in HNO_3 and the uranium is then purified by selective extraction of $UO_2(NO_3)_2$ into one of several solvents. The uranium is stripped from the solvent and, subsequently, recovered as an oxide. The UO_3 is reduced by means of hydrogen and the resulting UO_2 is hydrofluorinated to UF_4 with anhydrous HF. Extensive facilities are devoted to HNO_3 recovery and recycle.

The AEC has very large investments in existing feed material plants. The processing steps are not very complicated although highly corrosive materials are employed. The economics of large-scale production prevail in these operations. In addition, analytical services at the central facilities are integrated. Thus, costs are less on a unit basis than would prevail in smaller mills. None the less, it should be economically feasible to make UF_4 in many uranium mills now making yellow cake.

Proposed Integrated Process Outlined

The various purification processes which are described have in common the direct treatment of process streams in existing uranium mills. In general, uranium in an ion exchange eluate or a solvent extraction strip solution is reduced, extracted with a solvent solution, stripped with water and then precipitated as UF_4. It should be emphasized that these procedures have been investigated only on the laboratory scale. Pilot plant work will be needed in most cases.

The *All Solvent Extraction Process*

FIGURE 1

UF_4 PROCESSES

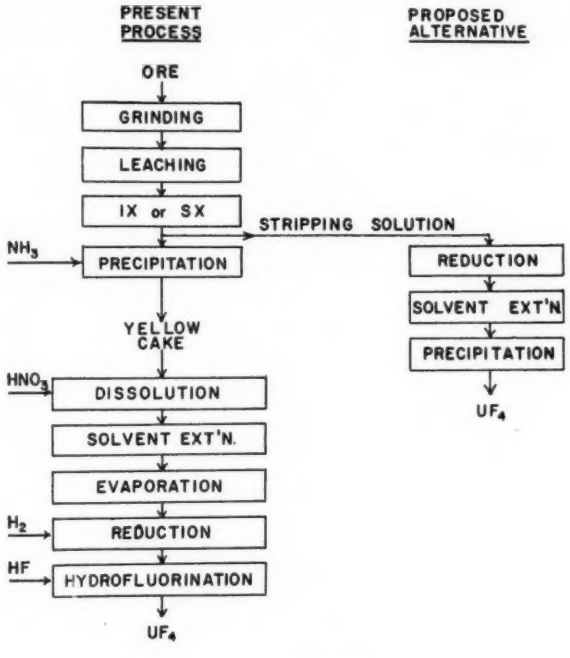
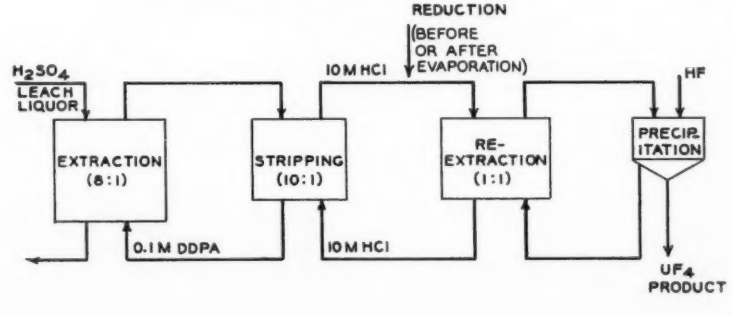


FIGURE 2

TWO STAGE SOLVENT EXTRACTION PURIFICATION PROCESS



which has received the most development to date is shown in the block diagram in Figure 2. This double solvent extraction scheme appears to be the most economical process for installation in new plants. The first extraction step is similar to that performed in a number of uranium mills now in operation on the Colorado Plateau. Either a monoalkyl or a dialkyl phosphate (DDPA or DAPEX process) in kerosene is used for extraction of the uranium from a sulfuric acid leach liquor containing UO_2^{++}. The uranium is stripped from the solvent phase by use of a strong hydrochloric acid solution. The monoalkyl phosphate is more suitable to HCl stripping than the dialkyl derivative because of higher stability. The uranium in HCl is then reduced to the uranous state. The final purification is achieved by extraction of the uranium from the HCl stripping solution with another solvent which is quite selective for uranium from these solutions. Various long-chain, secondary amines were found to be the most selective solvents. The uranium is stripped with water and UF_4 is precipitated by addition of HF. Alternatively, UF_4 may be precipitated directly from the solvent by contact with HF solution. The resulting product is then dried to yield a very high purity uranium tetrafluoride product. It should be noted that uranium passes through both a cationic and an anionic solvent.

In IX plants, either column or RIP, the eluate, either nitrate or chloride solution, can be treated by an *Ion Exchange-Solvent Extraction Process.* In this process, the uranium may be reduced either before or after extraction. Reduction before extraction has the advantage that the solvent can screen out impurities added during reduction. If a solvent of sufficient selectivity were available only one solvent extraction step would be needed.

However, the UF_4 products prepared by extraction of eluates with alkyl phosphates contain traces of several impurities which exceeded the specifications. Further purification can be obtained by introducing a second solvent extraction step. In this case, the uranium in the alkyl phosphate is stripped with strong HCl, reduced to the plus four state, re-extracted by an amine solvent, and then precipitated as UF_4. In either of these processes, it should be possible to make pure UO_2 or UO_3 instead of UF_4 if this is desirable.

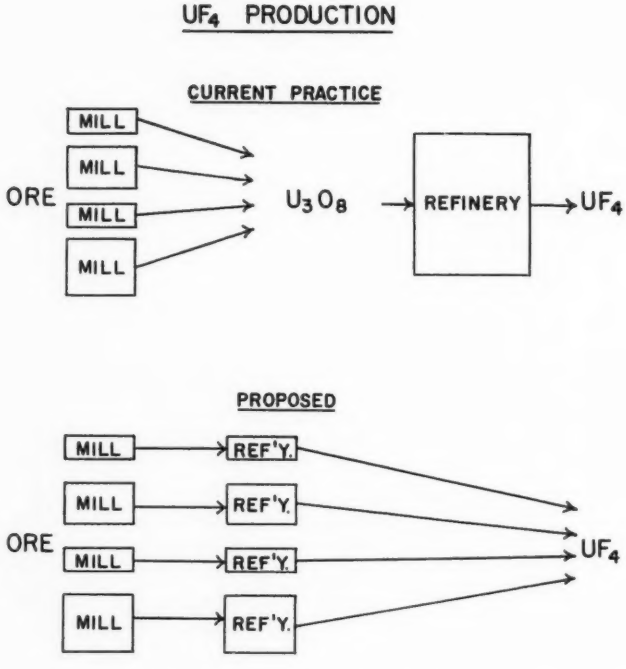
Uranium in sodium carbonate leach liquors and in carbonate stripping solutions of dialkyl phosphates in solvent extraction plants presents a more difficult problem for further upgrading. This is due to the lack of a suitable solvent extractant for uranium in Na_2CO_3. However, work is in progress on this problem at a number of installations, and a solution should not be far away.

Advantages of An Integrated Process Listed

There are a number of technical and economic advantages to be gained by using an integrated process instead of the present procedure. In the processes described, the uranium remains in solution throughout the processing and is progressively upgraded through the solvent extraction steps. Solvent extraction steps are easy to operate, are continuous, require little labor and relatively small investments. A plant having two solvent extraction trains instead of one is not difficult to conceive. Final stream flow rates are of the order of one to five gallons per minute in 1000 tpd mills. These streams may contain more than 100 grams U_3O_8 per liter. Thus, the additional amount of equipment needed to produce UF_4 in existing mills is not large. Such a process would offer the following benefits:

1. Production of UF_4 at uranium mills would make possible the elimination of some of the equipment and

FIGURE 3



raw materials involved in present yellow cake recovery. For example, NH_3 or MgO is used for neutralizing ion exchange eluates to recover yellow cake. This requires reacidification of the eluate before recycle. Both of these steps could be eliminated. Similarly, neutralization of the stripping solution in a solvent extraction process would not be required. The steps of yellow cake filtration, drying packaging and shipping across the country would no longer be necessary.

2. In existing AEC feed materials plants, operations all the way through UF_4 production would be eliminated with a considerable saving in operating and raw materials costs. The sampling plant and the acid dissolution steps would no longer be necessary.

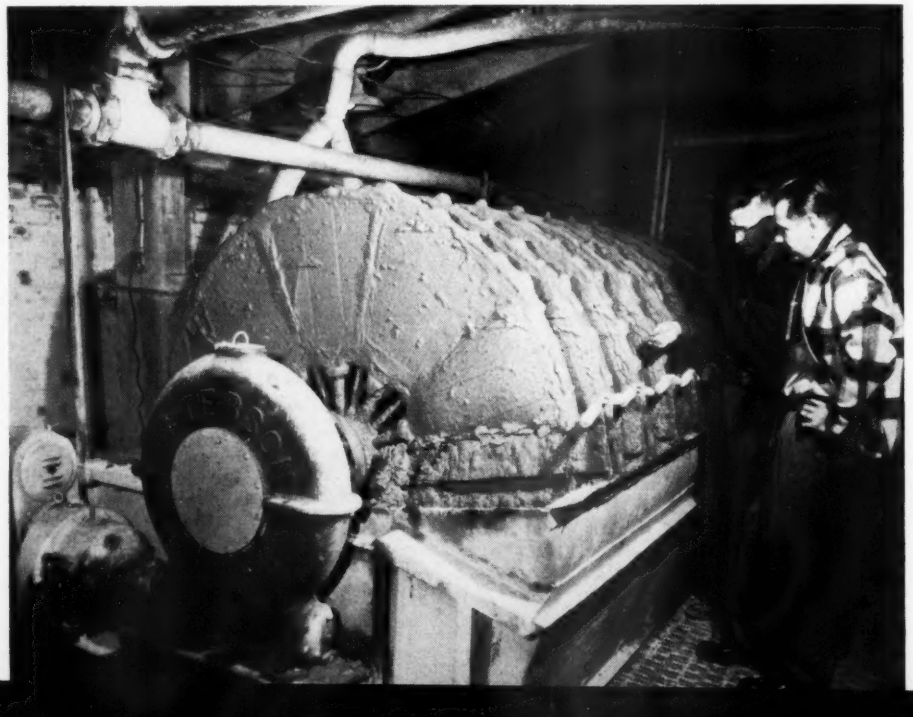
3. The use of HNO_3 with its concomitant problems and costs would also be eliminated. Hydrogen reduction of the oxide and the use of anhydrous HF would be removed from the flow sheet and replaced by aqueous HF and a more simple reduction procedure. H_2 gas manufacture from NH_3 would be eliminated.

4. The final product would be more valuable. Thus, the over-all profit would probably be higher. It may also be possible for a mill to obtain a higher depletion allowance in this case.

5. There would be numerous overall savings due to the elimination of processing steps and the concentration of the entire process at one installation. Thus, labor costs, clerical overhead, utilities and numerous other costs would be less.

These technical advantages would result in lower production costs if the mill had the same production rate as the present centrally-located, feed-materials plants. However, if these operations were actually carried out at the mills, the production rates would necessarily be considerably smaller since many mills are needed to feed a single, central refinery. This is shown in the diagram in Figure 3. Thus, this cost advantage would be partially, but only partially, offset by the increased costs due to this lower production rate. In preliminary cost calculations, it has been estimated that mills treating 1000 tpd of Colorado Plateau ore would probably be able to make UF_4 at a price competitive with the authors' estimate of present AEC costs. In larger mills, lower costs should result than those which now prevail at AEC plants. However, the increased complexity of control and analytical problems incurred in an integrated process by the larger number of smaller operations is a disadvantage.

In summary, the advantages of such a process outweigh the disadvantages, and the future possibilities of making UF_4 at the mill site look good.



It should be economically feasible to make UF_4 in many uranium mills now making yellow cake

Coal Mining Methods Applied to Hard Rock Operations

Flat-lying sediments are mined safely and economically

By ROBERT F. LOVE
Assistant to Resident Manager
Intermountain Chemical Co.

Robert F. Love graduated from Stanford University in 1941 and began a busy and varied career. He has held mine management positions with Westvaco Chemical Corp. and Sierra Magnesite Co. in California and Nevada. Love undertook assistant mine superintendent duties with Intermountain Chemical Co. in 1950, and steadily advanced to his present position of assistant to the resident manager.

THROUGH the years, coal mining has been a separate and distinct branch of the mining industry, and metal mining and most non-metal mining has been just as distinct and separate a branch. Very little information has been passed back and forth—a traditional barrier has existed. Companies mining flat-lying sediments have found that coal mining methods are not only applicable, but are essential to a safe and economical operation. Sometimes acceptance of coal mining methods has been a slow and reluctant process—especially if the company concerned has a background in hard rock mining.

Many mining companies have been operating in flat-lying sediments for several years; salt, limestone, potash, gypsum, iron, borax, trona, and probably many more have been mined successfully using what might be termed coal-mining methods. Mining ventures in flat-lying sedimentary rock is on the increase — especially with innumerable uranium operations being developed in the Intermountain area.

Reluctance to Accept Coal Mining Methods Overcome

In any flat-bedded deposit that is mined by underground methods, there are several phases of the operation which are very similar to those developed and pioneered by the coal industry. For example, the coal mining methods employed in mining and haulage systems, roof support, and ventilation are applicable in most cases.

The Intermountain Chemical Co. operates a trona mine near Green River, Wyo., known as the Westvaco mine, which is in a flat-lying deposit in the Green River formation. Access to the trona bed, lying 1500 ft below the surface, is by three circular concrete-lined shafts. Modified coal mining equipment takes care of the face mining, and ore haulage is by belt conveyors. A room-and-pillar system with pillar extraction is used. Roof support of a weak, laminated shale is entirely by roof bolting. Substantial quantities of methane are released when the roof caves so that sufficient ventilation is essential. It is evident the mine fits into the category of a hard rock mine which has adopted coal-mining principles. Most of the mining personnel had previous experience in hard rock mining and, consequently, in the initial stages of mine development, the acceptance of some coal mining methods was a slow process. Today they consider themselves "coal miners" and can point to an over-all efficiency of 25 tons per man-shift, a daily production of 3000 tons, and an outstanding safety record as worthwhile accomplishments.

Many Factors Influence Choice of Mining System

The selection of a mining system is usually the first problem to be solved by the operator. Variations of methods of extracting a nearly horizontal deposit are many-fold. Some of the factors which influence this choice are: the percentage recovery required, the amount of cover over the deposit, the strength of the overlying rocks, the strength of the material being mined, the strength of the floor, the type of ventilation required, the type of haulage anticipated, the rate of advance, the kind of mining equipment, and any special conditions like ground water, gas, multiple seams, etc. The selection of a mining system is a complex decision and one that may be changed several times as experience dictates.

Where total extraction is not essential and the cover is less than 500 ft, or where surface subsidence can not be tolerated, a room-and-pillar system of mining probably can be used to the best advantage. In deep deposits the percentage extraction which can be achieved successfully is usually limited to something around 40 percent. Higher extraction in working areas is possible; but if the area to be mined is quite extensive, the weight of the overlying rock will very probably shift due to a yielding of the supporting pillars, and that dreaded condition known as a "squeeze" can develop. Many variables enter into when and how this squeeze may develop, but something less than 40 percent extraction is accepted as necessary in mining at depths of 1000 ft or more. At Westvaco, the initial room-and-pillar mining with 50 percent extraction showed evidence of a weight transfer to adjoining blocks. The area mined without pillar extraction was quite limited in size, but we felt that a continuation of room-and-pillar mining with 50 percent extraction would definitely be unworkable. All pillars are now being extracted. If a squeeze does develop, mining can become impossible because of increased stress on any mining openings. The only ways to stop a squeeze, which may follow your workings and increase in potency, are to leave a large barrier pillar or to extract pillars and get the roof to break and thus prevent this traveling weight transfer.

In deposits where room-and-pillar mining is possible, the cost of mining most likely will be less than in a system where pillar extraction is necessary. The disadvantage of a greater rate of advance and, consequently, an increase in capital required for haulage, power, ventilation, etc., is more than offset by the advantages of better roof conditions, consistent working cycles, and generally safer working conditions.

Extraction of Pillars Presents Problems

Where total extraction is essential,

Automatic protective devices on the belts, and at each transfer point, prevent damage and permit a high rate of production with a minimum of operating personnel

some system of pillar removal and subsequent roof caving must be developed. Methods of pillar extraction are almost as numerous as mines extracting pillars. The system chosen for a particular operation must permit maximum recovery and protection for men and machines. The strength of the roof is probably the biggest element in deciding on the best system. If the roof is a competent sandstone that will stand unsupported as a cantilever beam for a reasonable time, the method of attacking the pillar is not too critical. Open ending, or skipping, which are merely methods of slicing off the end of a pillar, are simple ways of pillar recovery when conditions are right. A strong roof is not especially desirable in pillar mining because of difficulties in getting a good cave, but with a strong roof the immediate pillar recovery is simplified. A longwall system can also be used to good advantage where the immediate roof is fairly strong.

When the roof is weak and needs close support, some system of pillar splitting is usually required. In pillar splitting, cuts or lifts are taken through a pillar so that the maximum ore is removed, but sufficient pillar is left to support the roof while the ore removal is in progress.

Many variations to pillar splitting have been developed to fit certain conditions, but there are several general rules which apply to almost every pillar mine.

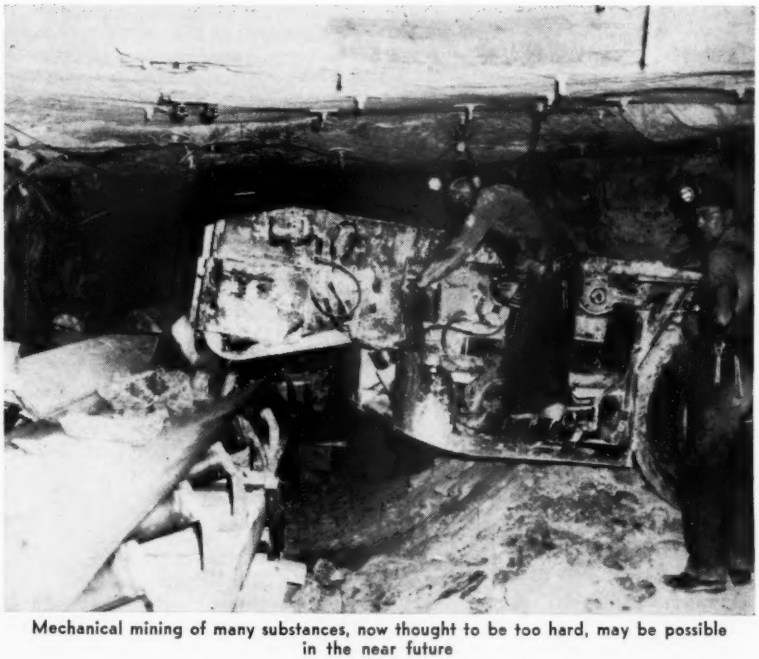
First, pillar removal must be systematic; pillars must be removed so that a cave line will be maintained. This cave line must advance in a regular fashion and usually close to a straight line. Cave line is controlled by order of pillar removal and by breaker rows of timber.

Second, pillar removal must be complete or such that any remaining stumps will crush-out with increased pressure. Incomplete recovery will prevent proper caving of the roof and serious overrides of weight can develop in the working area. The prime purpose of pillar extraction is to relieve the weight of the overburden on the active mine workings. If the roof does not cave completely so that a break in the roof beam is obtained, pillar extraction will prove to be a detriment to successful operation. The pressure arch theory of weight transfer can be observed in many mines where complete extraction has not been realized.

Third, pillar extraction should be rapid. The faster that the pillar mining progresses, the better will be the mining conditions—assuming that pillar removal and caving are proper. In some coal mines, pillars are purposely stressed to break the solid coal and thus reduce the effort put into the mining. This could possibly be used in some softer ores, but only experience could prove the feasibility.

Fourth, pillar extraction should be accomplished on the retreat and, for best results, should follow closely the initial mining in the area. There are systems of pillar extraction which can be worked on the advance, but barrier pillars are required which reduce the percentage extraction and ventilation is difficult; such a system is not desirable in gaseous mines. Of course, the reduced development expense is an advantage. Pillar removal in an area where pillars have been standing for many months or years is not recommended—especially where the immediate roof is weak and air slakes or breaks the rock.

At Westvaco, we have settled on a pillar-splitting system. Rooms are driven 20 ft wide on 48-ft centers at right angles to the development or haulage entries. Each room is 250 ft long and connects with the lower entry of the adjacent previously mined block. A line of pillars, each pillar 28 ft wide and approximately 100 ft long, is left between the rooms. Pillar extraction follows immediately after completion of the initial mining of a room, and is accomplished by driving a series of 20-ft wide lifts through the pillar—starting at the far end of a room and retreating towards the haulage entries. A five-ft



Mechanical mining of many substances, now thought to be too hard, may be possible in the near future

wide fender, or protective pillar, is left between the 20-ft lift and the cave; thus, men and machinery do not work under any unsupported roof. The size of the fenders is reduced if conditions are satisfactory, but the ore left in these fenders is blasted when the lift through the pillar is finished and very little of this ore is recovered as roof caving usually follows immediately. About 85 percent of the available ore is expected to be recovered by this method. Conventional timber is used as breaker rows to provide close control of the cave line.

A brief experience with longwalling in Westvaco indicated that our roof was too weak and tended to shear directly above the advancing longwall face. With the proper roof conditions and with equipment designed for mining and haulage of a longwall system, some operating advantages can be realized.

Some Modified Equipment Available —More Yet to Come

Because of the added hardness and weight of most ores when compared to coal, a lot of the highly mechanized machinery developed for mining coal is not applicable. However, in many deposits where hardness and weight are not excessive, a great many machines have been adapted; this is especially true in the haulage systems.

Continuous mining is, of course, a goal all operators strive to achieve. In coal, and several of the non-metallic ores, continuous mining and haulage have been achieved. The fact that a deposit can be drilled indicates that a method of continuous mining could be developed if cost and rate of production were not considerations. But, they are prime considerations and, consequently, to date continuous mining has been limited to the softer and more friable rock. Improvements in cutting bits, available horsepower, and rock breaking action has enlarged the scope of these machines.

Westvaco has sought to prove for several years that continuous mining of trona is economically feasible. To compete successfully with present conventional mining methods, a continuous miner should produce 500 to 600 tons per operating shift. To date, a manufactured miner has not been found that can do this; however, it is certain that a properly designed miner would operate in trona successfully with very worthwhile cost savings. Possibly a continuing pressure on designers and manufacturers will make mechanical mining of many substances, now thought too hard, possible in the near future.

Recent developments in high pressure, hydraulically powered, auger drills show promise of an adaptation of a coal mining method to surprisingly hard rock. At Westvaco, Carlsbad, and in many other non-metallic operations auger drilling is in use. New developments using bit pressures of several thousand psi are making possible the drilling of sandstones and other rocks of similar hardness. A self-propelled, rubber-tired, Joy CD-42 auger drilling machine is used at Westvaco for high capacity face-drilling.

Coal loading machines, modified for work in trona, make production of over 1000 tons per machine shift possible

Undercutting working faces of many deposits is impossible with equipment available today, but some of the advantages, wherever it is possible, should be pointed out. Advance per round can consistently be increased as much as 50 percent, and the amount of face drilling and explosives required can be substantially reduced. The usual undercut across the full width of the working face has been adapted by making a narrow, 4 to 6-ft wide and 10-ft deep undercut in the center of face. This retained most of the advantages of undercutting without the time delay and high maintenance caused by a hard-cutting material. The Joy 15RU universal cutter with a 10-ft Bowdil bar has given good results at the mine.

Mucking or loading machines with capacities of 10 tons per minute are common in coal and many non-metallic mines. Most coal loading machines will not take the abuse caused by heavier and harder ores without excessive outage and maintenance costs. Goodman 665 loading machines have been modified for work in trona, and even though maintenance costs are probably double many coal operations, a thorough preventive maintenance program has kept the operating outage at a very low point and has allowed production of over 1000 tons per machine shift.

Haulage System Gives High Performance

Most haulage systems developed for coal are adaptable to any flat-seam mining. Shuttle cars, fast extending and retracting shuttle belts, high speed conveyor belts, primary crushing ahead of belt transportation, modern mainline track haulage, and rubber-tire personnel-and-supply haulage are a few of the developments which have aided the increase in efficiency of many mines.

At Westvaco, all ore haulage is by belt conveyor. Some 3000 tons per day are transported over 1½ miles from working areas to the shaft bottom. The ore passes over three different belts, over two direction-changing transfer points, and through a single roll crusher. Ore is produced in four different areas. Thus, coordinating all belts to achieve minimum outage is quite an accomplishment. This haulage and crushing system is manned by only two men per shift. Automatic protective devices on the belts, and at each transfer point, prevent damage and permit a high rate of production with a minimum of operating personnel. Some of the devices and methods which permit automatic haulage include: (1) Specially designed transfer points which change direction of ore flow, and screen out fines to lower belt so that large lumps are cushioned. These transfer points are designed to be as "plug-proof" as possible, but protective devices stop the belt and prevent damage if a "plug-up" occurs. (2) All belts are interlocked electrically from centrifugal switches and a system of weighted-idler switches which prevent overloading of the main belt by coordinating feeder belt operation. This system reduces outage at face loading points and permits the haulage system to handle maximum tonnage. (3) Side-loading points on the belts in the face areas are equipped with one side board which raises and lowers as needed. If ore is loaded on the belt at a point behind the side-loading station, the moving ore on the belt rotates the side board out of the way and a counterweight returns it to the dumping position when the ore has passed. Electrically operated side boards have been tried and these are worthwhile at permanent transfer points. (4) Proper installation and conveyor alignment reduce spillage and, consequently, reduce the cleanup labor required and the abuse to conveying equipment.

The fairly recent development of extensible conveyors and wire rope supported conveyors or a combination

of both has proved very successful for temporary, but high capacity, haulage. The extensible belts were developed for use with continuous miners, but there should be application for this equipment in non-continuous operations. These units have some 100 ft of belt reeved in the drive section and are quickly extended by moving the self-propelled tail section and adding idlers. A rope-supported belt conveyor is operating at Westvaco. In panel belts, where extension and retraction is a perpetual function, this type of conveyor has several advantages plus a lower initial cost.

Most of the newer mines which are using belts for mainline ore haulage are confronted with the problem of face haulage to the belt and with personnel and supply transportation problems. Many mines have gone to trackless haulage and have adopted rubber-tire equipment designed for the job.

The well-known shuttle car does an excellent job of hauling ore from the working face to the belt. These cars are made in various sizes and designs and can be electrically powered (either battery or trailing cable) or diesel powered.

In mines where riding on belts is prohibited, either for safety or economical reasons, personnel and supply transportation can be furnished by various trucks or tractors and trailers. At Westvaco, converted Willys jeeps are used which have electric motors and are powered from an overhead trolley. These jeeps pull two-wheel rubber-tired personnel trailers. Small, three-wheel battery powered scooters, which were made for golf courses, provide fast and convenient transportation for supervisory and engineering personnel. For supply haulage a diesel powered jeep pulls various trailers especially designed for their load; i.e., powder, timber, bolts, etc.

Both Roof Bolts and Timbers Used

Roof support is one area where a coal or non-coal mine can be identical. In mines where the overlying rock is strong, and where only partial extraction is attempted, roof support can be a rather minor problem. But, in mines with weak roof, or where high extraction is undertaken, roof control can be the most important problem.

Roof bolts have received widespread acceptance in most flat-seam mining during the past seven or eight years and are the best answer to the problem. Some mines may find reasons, such as irregular jointing in the rock or low cost of conventional timber, so that roof bolts can not be justified, but in most cases a standardized system of roof bolting will prove advantageous. Some doubt has been expressed as to whether roof bolts can be used if roof caving is anticipated. In the Westvaco mine, a bolted roof will cave just as satisfactorily in pillar work as an unbolted roof. If the abutment support for a roof beam is removed, the roof will cave. In some mines roof bolts are salvaged before caving takes place; but if roof conditions are poor, the cost of the salvage work may be excessive. A long-handled power wrench is used successfully for this operation in one Illinois coal mine.

Type of bolt and installation equipment vary with the type of roof being supported. With the new developments, mentioned previously, in auger drilling, most operations are going to expansion-shell bolts and rotary drilling. Westvaco is using the Pattin shell on a ¾-in. diam., five-ft long bolt. Hydraulically-powered Joy rotary drills can drill the five-ft hole and install the bolt in less than two minutes. Dust collectors installed on the steel centralizers at the end of the feed rack do a good job of eliminating the dust hazard.

Mining systems using conventional timbering are common. Even in most roof bolted mines, conventional timbering is needed—especially in pillar extraction work. The so-called breaker rows which control the roof cave and cause the roof to break at a certain point are a vital part of any caving system. Most miners still like to have a few timber stulls installed to act as "squealers" if nothing else. A bolted roof could be very treacherous because of the lack of warning prior to an unexpected cave.

Westvaco has found that a lot of unusual roof failures were related to a contained gas pressure above the mine openings. Now, 20-ft deep vertical holes are drilled into the roof at regular intervals to relieve this pressure.

Many Ways to Provide Adequate Ventilation

The ventilation of a coal mine is usually much more critical than a non-coal mine, but methods used are certainly adaptable. In a modern, round-the-clock operation, with only a short interval between shifts, a well-organized and efficient ventilation system is a must. In mines where reduced ventilation is required, because of insufficient natural ventilation or noxious or explosive gases, various systems are used.

To seal or not to seal, that is the question. In mines where only partial extraction is attained, sealing off mined-out areas probably is most advantageous. More efficient use of the air can be gained, and the area to be patrolled or inspected is kept to a minimum. However, in mines where pillar extraction is used, and especially in mines where explosive or toxic gases could be generated, a system of ventilation which provides an adequate and positive flow in all areas is essential. It is recommended not to seal mined-out areas and to use a uni-directional system which takes ventilating air through the mining areas and then out a bleeder entry at the opposite end of the area.

Much has been said about the advantages of a ventilation system where the fan is exhausting over a system where the fan is blowing. It is felt, however, that the direction of the air through the fan is not important; but rather, the coursing of the air so that haulageways, working areas, etc., are on fresh air is what is important. The very small difference in absolute pressures in the two systems causes a negligible effect.

In controlling the ventilating air as it is coursed through the mine several devices long used in coal mines will be found to be worth investigating. Brattice cloth, stoppings, and overcasts are some of these devices.

Brattice cloth can be used for temporary blocking of an abandoned opening or it can be used to course the air to the immediate working face with what is known as a "line brattice." Effectiveness of brattice is directly proportional to the care taken in installing and maintaining it.

Stoppings are the key to an efficient ventilating system. The percentage of the available air which reaches the working area is known as effective air and with a minimum of leakage on all stoppings this can be kept above 75 percent; 8 by 8 by 24-in. wooden blocks laid skin to skin, and then plastered with a non-shrinking cement and a sealing compound, provide the most economical stopping. These resist crushing, are quickly installed, provide air tight sealing, and are salvagable.

Overcasts are the devices which permit the intersection of two air streams without mixing—in other words, the crossing of intake and return air. Prefabricated steel-plate tunnel lining is very satisfactory. Westvaco's mining system calls for a series of overcasts in each mining area. When the area is mined out, the overcasts no longer are needed and the prefabricated, sectionalized structures are removed and reinstalled.

In states where blower fans are permissible, the use of nylon-fabric ventube will be found to be a cost-saving move. The loss of ventube because of tearing is practically eliminated by this strong fabric.

It is hoped some interest has been aroused in the minds of those operators who may not like to admit that their flat-lying deposit can be best operated as a coal mine.

Mine Fire Hazards and Fire Fighting Equipment

Since the subject covers a wide field with many ramifications, the author concentrates on the importance of (1) preventing the occurrence of fires, (2) maintenance of equipment, (3) training and (4) procedures employed. He also considers some new developments and the use of a-c equipment from a fire standpoint

By J. S. WHITTAKER
Vice-President, Pittsburgh Coal Co.
Division of Pittsburgh Consolidation Coal Co.

FIRES caused by arcs from trolley wires which have been dislodged from their hangers by falls of roof on haulage roads have been minimized in recent years by the common use of roof bolts. Grounded trolley hangers, however, present a problem, particularly during the summer months. Mines employing 550-volt systems are affected to a greater degree than lower-voltage operations.

The danger of belt fires has been minimized by the introduction of fire-resistant belt material. Although there are probably many ordinary rubber belts still in active service, they are being reduced in number through state and Federal agency requirements for fire-resistant belting in coal mines.

The danger of fires which are initiated by explosives is being reduced by the increased use of continuous mining equipment. This hazard existed primarily in pillar work where the bulk of continuous machines are now employed.

Face areas in most of our mechanized coal mines of today are more vulnerable to mine fires as the intensity of mechanization increases. Practically all of the fires which our company experienced during the past seven years have occurred at or near the working face. The immense machines in use require large quantities of hydraulic fluid to enable them to operate efficiently. This fluid consists of inflammable hydraulic oil of various viscosities dependent upon the characteristics of the equipment in which it is used. The origin of the majority of these face area fires involves a ruptured electrical cable in the presence of grease, hydraulic oil and coal dust. Cables become fouled, pinched, run over by equipment or crushed by lumps of coal and rock, causing blow-outs which may ignite oil or grease.

Prevention of Face Fires

Pittsburgh Coal Co. is attacking the problem of preventing face fires by:

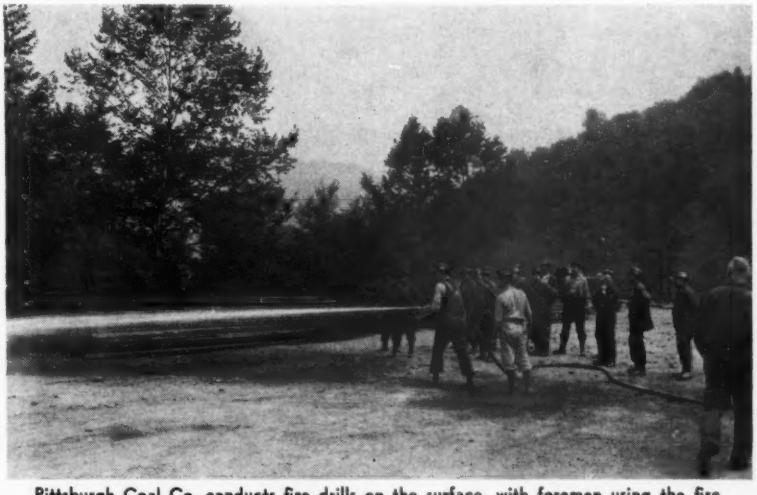
1. Everyday instruction to machine operators by line personnel. In addition, inspectors from our safety department discuss proper cable handling, the safe way of handling hydraulic oil, and other safety problems with the men in groups, at a convenient location on the working section.

2. Extending the use of circuit breaker protection for each machine used at the face.

3. Maintenance and general housekeeping of electrical equipment.

Materials and Equipment for Fire Protection

Recognizing the need for increased fire protection, our company purchased for each operating unit a 150-lb capacity dry chemical tank mounted on wheels. These units are equipped with 50 ft of hose and a controlled feed nozzle through which the dust can be expelled under high pressure. They have proven to be extremely ef-



Pittsburgh Coal Co. conducts fire drills on the surface, with foremen using the fire cars and chemical extinguishers available at the mine. Such experience becomes extremely valuable when an actual fire is confronted underground

The centrifugal pump on this fire car is capable of delivering 100 gpm of water at 90 psi nozzle pressure through 600 ft of two-in. hose

fective in controlling Class B fires involving oil and grease.

Each section also has from two to four 20-lb and 30-lb dry chemical extinguishers which are mounted on certain machines and at loading heads.

Within the past year each mine was equipped with two or more fire cars of 2200 gal capacity each. The centrifugal pump on this car is capable of delivering 100 gpm of water at 90 psi nozzle pressure through 600 ft of two-in. hose. These cars are placed at strategic locations within the mines, readily accessible for transportation to the scene of a fire. In addition to these cars, 1000 gal capacity fire cars, capable of delivering 100 gpm at 80 to 100 psi are available for emergency service.

Self-rescuers, gas masks, and emergency tools and materials are stored at stations located within and outside the mine. Each working section in the larger mines is equipped with a two-in. spray line for dust control at the working face. These lines have outlets every 200 ft where hose can be attached. Water is supplied to each working face through one-in. rubber hose at 40-60 psi with a free flow volume of about ten gpm. Mine drainage lines, consisting of three- to four-in. steel pipe and six- to ten-in. cast iron pipe, are supplied with fire hose outlets at 500-ft intervals along haulage roads. All fire plug outlets are marked with reflecting signs. In dry mines rock dust machines are available on each unit in conjunction with a supply of rock dust.

Training of Personnel

Of equal importance to the maintenance of equipment and supplies is the training of personnel in their proper use in the event of an emergency. Foremen and workmen are instructed at least three times each year on the job. Members of the safety department organize this work at the mines and conduct 15 to 20-minute group meetings near the working face. Men are instructed in fire prevention and in procedures to employ should an emergency arise on the section. Key men are designated to disconnect power to equipment, call the outside for help, secure fire fighting equipment, direct the ventilation and secure first aid and respiratory protection. In addition to the training, major fire fighting equipment is marked with easy step operating procedures.

On the surface, fire drills are conducted with foremen using the fire cars and chemical extinguishers available at the mine. Actual fires are extinguished by the foremen working as a team. This experience becomes extremely valuable when an actual fire is confronted underground.

Conclusions

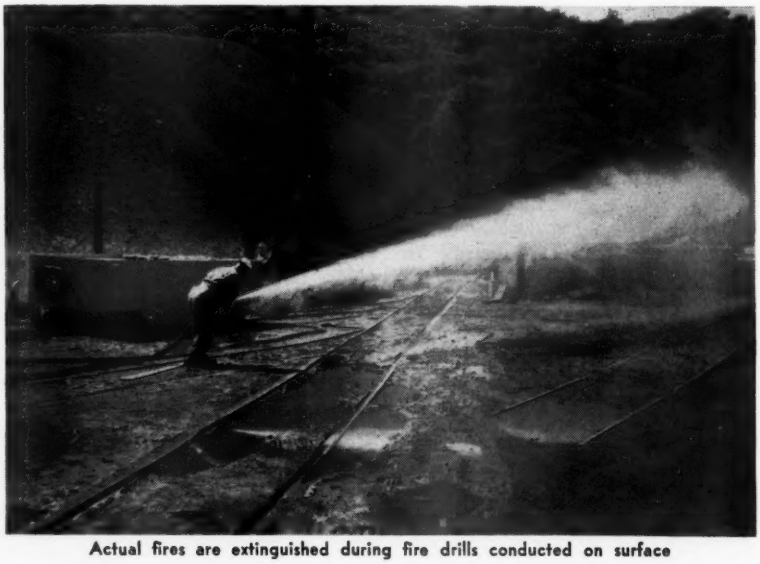
Prevention of fires is of utmost importance at any mining operation. In addition to the training of personnel and the employment of circuit breaker protection, a suitable economical noninflammable hydraulic fluid is needed. Much research has been spent on this development. However, nothing to date has been developed which is economical to use in the mining industry.

Improved cables for d-c equipment would enhance the safety of operation. It is understood that new developments are forthcoming in regard to cable construction.

Consider the possibility of piping certain equipment with spray nozzles directed to vulnerable areas of the equipment. This is being done by one company in northern West Virginia and probably by others. This development would minimize the possibility of an oil and grease fed fire from spreading in inaccessible areas of a machine.

In new installations consider the use of a-c equipment. The general consensus of opinion is that a-c equipment is more efficient and is less hazardous from a fire standpoint. Also, in conjunction with the use of a-c face equipment, diesel locomotives could be employed to transport coal and thereby minimize the hazard of mine fires and gas ignitions. Personal contact hazards could be eliminated insofar as haulage is concerned.

At new operations great protection could be achieved by an installation employing an outside source of water. By piping the entire mine with fresh water the optimum in fire protection could be obtained.



Actual fires are extinguished during fire drills conducted on surface

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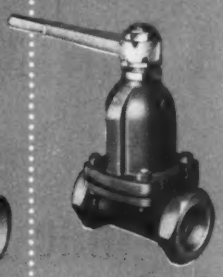

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Body linings — hard rubber; soft rubber; neoprene; glass; lead; plastics; Heresite; Lithcote

Diaphragms — soft natural rubber; natural rubber; white synthetic rubber; neoprene; reinforced neoprene; butyl; Hycar; Teflon; Kel-F; PVC (polyvinyl chloride); polyethylene

Bonnets — iron; stainless steel; bronze; other materials on special order

Choice of Bodies

Conventional weir type

Straight bodies — screwed; flanged; socket weld; butt weld; socket (solder); sanitary threads; hose ends; Victaulic

Angle bodies — screwed; flanged; socket weld

Other types

A line of Straightway Valves (for straight-thru flow) and Full-Bore Valves (for ball brush cleaning) also are available

Choice of Bonnets

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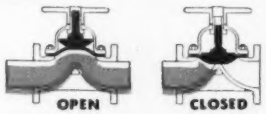

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PLANNING A NEW MINE:

Mine Layout, Haulage, Production

In describing the planning and development of Orient Mine No. 3, the author emphasizes that management should be prepared to change its plans during the planning stage of a new mine, and at intervals throughout the life of the property, to take advantage of new types of equipment

By F. EARLE SNARR
Vice-President (Operations)
Freeman Coal Mining Corporation

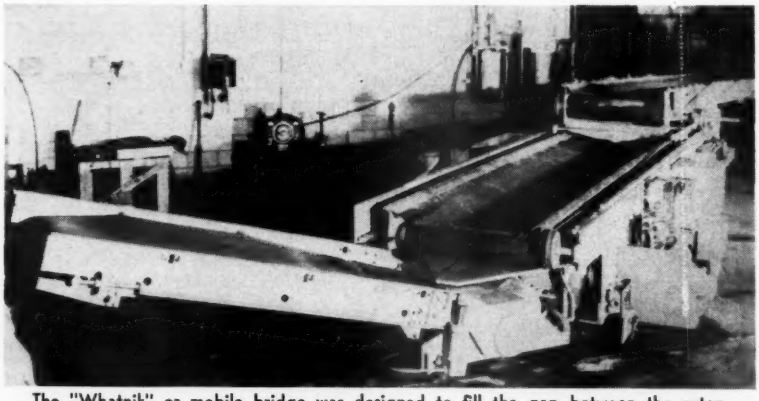
BEFORE describing Orient Mine No. 3, it may be worthwhile to outline basic considerations that must be carefully evaluated before the first lines are put in the preliminary drawings or the first figure set down in the cost estimates for a new mine. This will be done by using personal reference.

The writer's initiation into the coal industry dates back to the early Twenties when he was employed as an engineering draftsman by Chicago, Wilmington and Franklin Coal Co. in southern Illinois. His first assignment was that of making several dozens of bottom layouts for a new mine which later was to become the New Orient Mine.

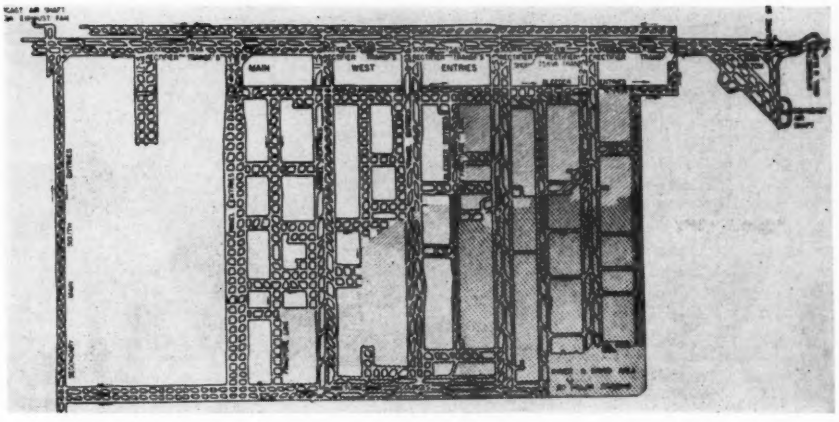
First Step Toward Mechanization

The industry was just emerging from the age of shooting coal off the solid with black powder. The first step toward mechanization had been made. Old air-driven puncher machines could still be found lying around in the gob and a mine was considered modern if it had shortwall cutting machines. Locomotives were being used on the main line haulage and mules still gathered the coal from the face to the inside haulage partings. Of course, all coal was hand loaded with a No. 2 shovel into the pit cars. Production was limited to one eight-hour shift a day, so for a mine with a projected tonnage of 12,000 tons, everything was necessarily planned big.

There were coal reserves blocked out for this mine that would last 40 years or more. The No. 6 coal seam at this location was nine ft thick over the whole acreage. The grades were generally flat and the roof consisted of uniformly well bedded shales as indicated by widely spaced test holes. These good natural mining conditions could be relied upon, and planning was confined to designing an underground system that would provide for ventilation and haulage for the life of the property.



The "Whatnik" or mobile bridge was designed to fill the gap between the extensible room belt and the continuous mining machine. The device is self-propelled and can extend to reach some 54 ft and retract by telescoping to a minimum of 22 ft



Mine map shows original mining method using two-sided panels. This plan developed problems in keeping ventilating pressure on all units at the fracture line. Crosshatching shows pillars extracted and area caved

The underground power system needed modernizing from previous requirements in order to operate gathering locomotives and undercutting machines, and to provide a margin for possible later introduction of mechanical loading devices that were in the talking stages at that time.

During the 25 years between 1922 and 1947, the loading machines arrived as did universal cutting machines, mobile drills and all the rest. New Orient pioneered in the development and introduction of many of these mechanical mining devices. Joy 4-BU loaders were tested and installed in 1923 along with Myers-Whaley machines, both to be replaced shortly by the Joy 5-BU's. McKinlay entry drivers were installed in 1926. Sullivan CLU cutting machines were installed in 1929 and production was placed on a full mechanized basis at that time. The wash house designed in 1922 to accommodate 2000 men was now half empty, following full mechanization. Underground production employed the mechanized equipment on two shifts and production territories were reduced by half. By 1947 that 40 years of coal reserve with good natural mining conditions available in 1922 was fast being depleted.

Now the foregoing picture applies to mining companies and their coal reserves throughout the country pretty much the same as it did to C. W. & F. and its Orient mines. Certainly this company had other large reserves of the same seam of coal, but they lay at greater depths and prospect holes showed more irregularity of the coal seam contours. Tests also showed that roof overlying the coal seam consisted of unconsolidated shales from 4 to 40-ft thick.

Continuous-type Machines Used to Drive Slopes

These factors, coupled with a conviction that more coal must be produced with less labor in order to offset increased cost of developing and equipping a new mine, were what management had to start with when the planning of Orient Mine No. 3 was started in 1947.

Orient No. 3 is located about 1½ miles southwest of Waltonville, Jefferson County, Ill. The No. 6 seam now being worked there is penetrated by twin slopes that are set on 40-ft centers, length of the slopes being 2850 ft from the surface to the base of the coal seam. Slopes are driven on a pitch of 16° and each is 7 ft high by 12 ft wide. A unique feature of this slope-driving venture is the fact that nearly 75 percent of both slopes was driven by continuous-type machines that formerly had been used in underground coal mining the past 20 years. This feature represented a new "first" in equipment application in the coal industry, and the success of the project is attested to by many advantages, including cost and speed of slope sinking, that are inherent with the method and equipment used.

The mine was designed to produce 7000 tons of cleaned coal on each of two shifts. It has reached that capacity and its two-shift record to date is 15,358 tons of prepared coal, representing 17,000 tons of raw coal. The mine went into production in 1951.

Cutting an Arched Roof Aids Roof Control

Extensive drilling of the reserves blocked out for this mine, along with careful study of roof conditions in the nearest adjacent mine, led to the conclusion that roof control would be difficult and costly by use of conventional face preparation and mining methods.

As mentioned earlier, the company had been using McKinlay entry driving machines at New Orient mine continuously since 1926 to drive advance development entries.

To research the advantage of eliminating shooting on roof control, these McKinlay machines were placed in a section at New Orient having roof characteristics simulating those indicated for the new property. It was found that the cutting of an arched roof allowed this work to be driven without timbering or bolting, while companion entries driven simultaneously by undercutting and shooting methods required extensive timbering.

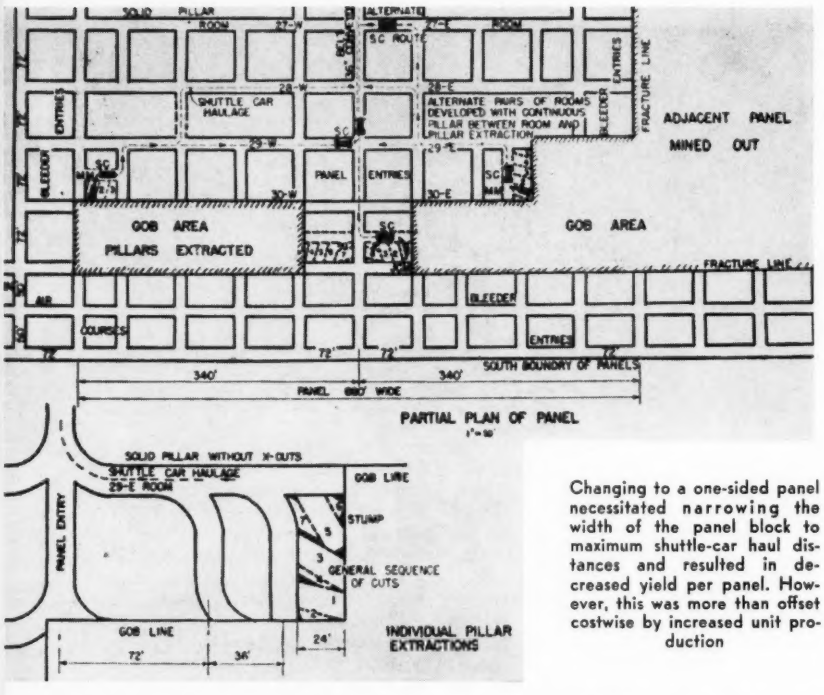
These findings led to a plan of mining centered around use of a boring type of continuous mining machine utilizing the principles of the McKinlay entry driver. Since it was judged that roof could be held in narrow work with such machines, it was decided that all advance mining should be kept narrow.

The McKinlay entry driver was successfully redesigned and built during a two-year program promoted by the coal company. The newly designed machine emerged as the Marietta continuous mining machine in August 1950. All of the desirable features of the McKinlay were retained in the design of the Marietta machine, and other features such as a crawler-type drive and provisions for retracting the cutting arms and lowering the top-cutting chain were added. The first Marietta was placed in underground development work at Orient No. 3 in September 1950, and this original machine has been in continuous double shift service to date.

Full Extraction Considered

Consideration was next given to a full extraction mining plan, even though this was contrary to the long standing philosophy that extraction of pillars in the No. 6 seam of southern Illinois by retreat fracture line methods would be impossible. The fact that the overburden at this location was more than 800 ft thick and that a limestone cap rock common in Franklin County just above the coal seam was not present in this area led to the belief that a fracture line could be developed and roof action controlled.

The company had considerable outside help in designing this mining plan. The author and associates visisted mines throughout Pennsylvania



Changing to a one-sided panel necessitated narrowing the width of the panel block to maximum shuttle-car haul distances and resulted in decreased yield per panel. However, this was more than offset costwise by increased unit production

and West Virginia, looking at every type of fracture line operation they could learn of. From these studies evolved the decision to adopt a flat fracture line principle of mine projection.

Underground Power Distribution System

Before considering the pillaring operations, let us examine Orient No. 3's underground power distribution system. The 69,000 volt a-c power, purchased from a public utility, is stepped down to 4160 volts and distributed underground in 8000-volt shielded cable suspended from a messenger wire along the roof. The extra insulation will permit changing to a 7200-volt system if it is deemed desirable and made permissible in the future.

At the main transformer station, a 46-ohm resistor in the neutral limits the ground fault current to 50 amp. This protects a workman who might be standing on the ground and touching the frame of a rectifier or transformer at the moment insulation failure might occur, limiting the voltage to about 100 volts.

The 500-kw, 275-volt d-c sealed tube Ignitron rectifiers are located at the mouth of each ½-mile long panel territory. About 9000 ft of 1,000,000 CM feeder cable are required to feed a fully developed panel territory. The feeders are doubled on both the positive and negative for the first 2000 ft and single the last 500 ft. Ample copper and substation capacity are essential to a system employing continuous mining machines. Peak loads should not disturb the system and outages are excusable only when fault currents are involved. This system has proven most adequate.

During the past year the mine installed a 5000-kva field transformer station, with automatic tap-changer on the 4160-volt side. This regulates the voltage in the midst of a group of four 500-kw underground rectifiers 9000 ft away from the transformer station. Transmission from this station to the circuit breakers on the bottom is through a cable bore hole.

The main line 48-in. belt conveyors are powered by 50 and 150-hp, 900 rpm, 440-volt wound rotor motors in tandem and are from 4000 to 5200-ft long. The 36-in. panel conveyors, which are 2500 ft long, are powered by 60-hp, 1200 rpm, 440-volt wound rotor motors. The starters for these motors have extra accelerating steps, controlled by motorized timers to permit the belt motors to accelerate slowly. This feature minimized belt stresses and take-up travel troubles. There have been times in this operation when a 36-in. panel belt carried coal from as many as five continuous mining machines for short periods. With the conveyors thus loaded to maximum capacity, it has been possible to stop and start these conveyors fully loaded at random without difficulty.

After completing the bottom layout, which consisted of connecting the slopes with the shaft housing, the automatic man cage and surge bin area, three main entries were driven a mile west to the location of the upcast fan shaft. Two companion entries were driven later to serve as return air courses. The mine is ventilated by a seven ft diameter axivane exhaust fan, powered by a 200-hp motor.

Equipment Used

The Illinois No. 6 seam varies from from 7 to 11 ft in thickness at this property and is nine ft thick throughout the greater part of the acreage. It was planned to use boring type machines equipped with seven-ft arms so as to leave one ft of bottom and one ft of top coal. The bottom coal is left to protect buggy roads from the soft underclay and is mined during pillar extraction. This added height also serves to provide travel clearance for the miners to offset bottom heaving when weight from the fracture line approaches. The top coal left serves to protect the weak overlying shales from deteriorating by exposure.

At present there are 14 boring type machines (ten Mariettas and four Goodman Type 400 J) and six Joy ripper type machines in service. Production is on a two-shift basis, with a third shift devoted to maintenance, supply delivery, belt moveups and other dead work.

All continuous mining machines are served by shuttle cars hauling to a 36-in. 500 fpm panel belt

The mine was developed to permit mining of one mile square areas split in half by five entry mains. The blocks on either side of the mains are mined and caved from three entry panels which are ½ mile deep and 576 ft wide. Boring type machines drive the panel entries on 72-ft centers and 90° crosscuts, also on 72-ft centers. Inby the 300-ft barrier pillar left along the mains, No. 1 and No. 2 rooms are driven both right and left for bleeders. Beyond No. 2 room the crosscuts in the panel entries are staggered. The 36-in. belt conveyor is located in the center entry. Another entry is used for track haulage to move supplies and workmen to the face. The d-c feeder cables are installed in the third entry.

The three panel entries are driven to the panel boundary where two bleeder entries on 72-ft centers are driven and holed to the outby panel to insure adequate ventilation of the gobbed territory. Chain pillars in these bleeders are later extracted from panels driven from the opposite direction.

In advance of the pillaring operation, two or more rooms are driven at the top of the panel on 72-ft centers by Mariettas or Goodmans and connected to the bleeders at the extreme back corner of the panel. Room crosscuts are made at 72-ft intervals. Thus, 60 by 60-ft blocks are formed across the panel for pillaring.

Flat Fracture Modified to a Stepped Line

The first try at pillaring followed the originally planned flat fracture line principle, using two Mariettas to develop the rooms and recover the room blocks and one Joy Ripper Type Miner to recover the entry chain pillars and the outby room blocks. This method was abandoned within the first year because the center block of entry pillars formed a focal point where pressure tended to ride over to the outer areas.

The flat fracture was modified to a stepped line, with the line in the first panel being offset some 300 to 500 ft from that of the adjacent one. This has proven advantageous since it is now only needed to keep the line in each panel even, and the solid coal in the step toward the next panel affords a suitable roof break without tendency to squeeze or ride over to the outby developed areas.

Originally mining was done from both sides of the panel entries. This plan developed problems in keeping ventilating pressure on all units at the fracture line, along with creating the necessity of crossing equipment over the belt line to maintain balance in the fracture line across so wide a face area. Now the pillar line is operated from one side of the panel only, and but one boring type machine and one ripper are assigned to each panel. This change necessitated narrowing the width of the panel block to maximum shuttle car haul distances and decreased yield per panel. This was more than offset costwise by increased unit production. It is expected that replacement of shuttle car haulage by continuous haulage will permit return to the wider panels and yet retain the one-sided panel.

The 60 ft square room blocks are recovered by splitting at the midpoint and from either the room or crosscut side, pocketing the ribs from either side of the split. Where crosscuts are caved, the blocks are split from the room side only and the ribs are pulled right and left.

All continuous mining machines are served by shuttle cars hauling to a 36-in. 500 fpm panel belt. This belt carries the coal to the 48-in. 550 fpm mainline belts which discharged to a shuttle belt over the 450-ton surge bin near the slope bottom. The shuttle belt's discharge position is changed by the surge bin operator to take full advantage of the bin's capacity. At this same level, drop bottom mine cars may be dumped in one side of the bin. The coal moves from the surge bin to the slope belt in the following manner: A bin apron feeder powered by an a-c to d-c variable speed drive, remotely controlled from the surface preparation plant 3000 ft away, regulates the feed from the surge bin to a short belt. This belt in turn discharges the coal underneath a large magnet and onto a motorized grizzly, pitching downward at a 20° angle.

The minus six-in. coal passing through the grizzly is used to bed down the slope belt. The plus six-in. coal passing over the grizzly falls into a single roll crusher and then it is deposited on the coal already on the slope belt. Coal is discharged at the surface cleaning plant 5¼ minutes later. This 42-in. 625 fpm, 1200 tph steel cored belt installed on a 16°, 3300-ft long slope was the longest single flight lift conveyor (868 ft) in the industry at the time of its installation.

Whatnik!

Trials have been made with extensible belt conveyors in the panel rooms dumping onto the panel belts. The extensible belts tested did not show appreciable benefits due to lack of carrying capacity to take coal from the shuttle cars at maximum discharge rates, and savings in haulage time were largely offset by unloading time losses.

For several years it has been realized that our company would not actually have continuous mining until continuous haulage becomes a reality. Management has tried to eliminate the shuttle cars by using a bridge conveyor between the continuous mining machine and the extensible room belt. The need to reach some 75 ft from the room center to the gob side of the pillar block called for excessive length and weight in the rigid type bridge, and this approach was abandoned.

In a continuing effort to attain the goal of continuous haulage, the company has the past several months been designing and building what it chooses to call a "mobile bridge" to fill the gap between the extensible room belt and the continuous mining machine. This device will be self-propelled and extend to reach some 54 ft and retract by telescoping to a minimum of 22 ft. (Not to be outdone by Comrade Khrushchev and his boys, one of our engineers gave it the title of "Whatnik.") Perhaps our company too is "shooting at the moon," but something like this could be the missing link in the secondary haulage chain.

New Mines Must Have Larger Reserves

Now that the writer has discussed planning mines of 35 years ago, and described an operation planned ten years ago along with changes already made, it might be well to observe that the industry is in just about the same position today with continuous mining machines that it was 25 years ago with loading machines. It may not see the introduction of devices to displace loading machines or continuous mining machines, but their mode of use will be ever changing as new auxiliary equipment is developed.

For the most part, existing coal reserves have less favorable mining conditions than those available when mechanization was first introduced. This forces us to plan and develop mines where the coal lies at greater depths or where the seams are thinner. These factors, combined with the doubling or even tripling of capital cost of developing and equipping mines today compared with bygone years, dictate that new mines have larger coal reserves and longer life to pay out the increased costs.

With present day progress in development of new mining equipment, it is not reasonable to expect plans made today would not need altering during the life of a property as could be assumed in past decades. In planning of new mines today, management would be "smart" to keep one eye on the crystal ball and give imagination a prominent place in its planning. It should be prepared to change its plans even during the planning stage of new mines and certainly at intervals throughout the life of the property to take advantage of new types of equipment, including those that are still only ideas or have not yet been thought of.

Operators' Corner

Wire Rope, With Intercommunication And Derail Signal Feature*

THE utilization of wire ropes in most underground mines is not new or news. However, when a progressive mine uses a wire rope, into which is imbedded two or three thin copper wires for the express purpose of establishing and maintaining contact and communication between the ore skips, main hoist and the hoisting engineer, it is news.

For the past 18-20 months, the Mining Division of the Alan Wood Steel Co., Dover, N. J., has been using and testing SignalKore Wire Rope, a development of the Wire Rope Divisions, American Chain & Cable Co., Inc., Wilkes-Barre, Pa. This wire rope is utilized to transmit continuous communication instructions through its center core of three copper wire conductors, as well as for the hoisting of skips of magnetite ore through two of the three mine shafts. The third shaft is used for hoisting men up and down, in the mine.

"These wire ropes," according to John Kerttu, mine superintendent, "have greatly simplified the problem normally encountered in signaling our moving hoists and skips during their ascent or descent. We like the voice communication aspects that the product affords us.

"With some 18 months of installation time behind it," stated Kerttu, "there have been no major maintenance problems encountered in the use of the ACCO product. It is true, however, that the hoisting ropes are subjected to mechanical abuses such as bending, reeving, stretching, and winding onto the drums."

Many Applications

Applications are limited only by user ingenuity. As an example, with two of the conductors engaged in voice communication, the third wire can be utilized in a derail warning system. When a skip is derailed, a circuit is made between contacts mounted beneath the skip and the rails. The closed circuit sounds a horn in the hoist room notifying the operator that the skip has been derailed.

SignalKore, according to its manufacturer, was made possible by the development of a practical method in which copper wire conductors are imbedded in a fibre core, which is then "laid-up" in the rugged steel wire rope. Thus, hoist ropes and other operating cables can be used to transmit low voltage current for continuous voice or signal communication through the wire rope itself. It can be used with standard phones and the newer sound-powered phones.

At Alan Wood, this signal-carrying rope has enabled the hoist engineers to keep in constant touch with the mine skip tender when necessary. Both of the ore hoists and the man hoist employ it. As a result, much smoother and more controlled operating cycles have resulted. It has made operations safer and faster and has supplemented the established blinker and bell system.

Since installing these ropes, the mine has hoisted more than 2,000,000 tons of magnetite ($Fe3O_4$) ore. Usually, between eight to nine tons per skip load is hoisted. Additional hoisting ropes with this continuous communication feature are now on order to be placed in service when required. All three of the shafts will then be equipped with 3800 ft each of SignalKore rope.

Advantages—Specifications

Faster and more efficient are two advantages claimed for signal-carrying rope. Much time can be saved because the skip can be stopped at any point in the shaft. Many extra trips are avoided with skips which formerly could not be stopped once a destination had been set. The product offers a greater convenience and efficiency in emergencies, shaft repair and shaft inspection.

Specifications of the hoisting ropes purchased by Alan Wood for the original order and re-order are: 1½ in. diameter, 6 by 21 filler wire, preformed, improved plow steel, lang lay, fiber center core rope, furnished with three color-coded, copper wire conductors each equivalent in size to a No. 22 AWG wire with a resistance of approximately 26 ohms per 1000 ft. These ropes have a breaking strength of 184,000 lb and weigh 3.6 lb per running ft.

Messages can be sent and received at this speaker's box located on top of the ore skip

* Courtesy of American Chain & Cable Co., Inc.

wheels of government

As Viewed by HARRY L. MOFFETT of the American Mining Congress

CONTINUED fall-off in employment has sparked both the Administration and Congress to push measures designed to prime the industrial pump. Even the putting into orbit of another U. S. satellite did not cause as much stir on Capitol Hill as the announcement that March unemployment had reached over five million persons.

The Administration has called for a speed-up in the letting of defense contracts, the road building program and in public works generally. The Congress has snapped through proposals to increase housing starts, and is giving study to boosts in reclamation and other projects calling for increased employment. At the same time much consideration is being given to recommendations for tax reductions, both to individuals and to industry. While the White House has been reluctant to advance proposals for tax relief, taking an attitude of "wait and see" whether there will be an upturn shortly, many key legislators in the Congress have been joined by labor leaders in calling for early action in this field. Many experienced observers are freely predicting that tax reduction will come by mid-year.

Meanwhile, the Federal Reserve Board has released a report for the past month showing a downturn in mineral production and employment, including petroleum. The problems of the mining industry have also come into sharper focus in the Nation's capital, with more and more demands being made for amendment of the Trade Agreements Act to protect major segments of the industry, and with the Senate Interior Committee initiating hearings into proposals for national mineral policies.

Congress will begin its 10-day Easter recess on April 3 when members are expected to visit their home States and districts and obtain the first-hand views of their constituents or problems of national interest.

SENATE COMMITTEE CONSIDERS MINERALS POLICY

At this writing, the Minerals, Materials and Fuels Subcommittee of the Senate Interior Committee is beginning hearings on national minerals policies. The hearings were called by Senator James Murray (Dem., Mont.), chairman of the committee.

In announcing the hearings, Murray said, "it is my hope that out of these hearings and the cooperation between the committee and the several executive agencies who will be called upon to testify, that a formula can be devised which will give strength and stability in peacetime to our all-important minerals extractive industry and to provide an impregnable foundation for the maintenance of the mobilization base necessary to carry the nation through an international emergency."

Murray emphasized there would be no conflict between the hearings by the Interior Committee and other committees of Congress considering specific proposals for individual minerals. He said the hearings were being held in an effort to supplement the work being done by other committees.

During the hearings, the committee will hear from representatives of the Office of Defense Mobilization, Commerce and Interior Departments, and the various branches of the mining industry. Julian Conover, executive vice president of the American Mining Congress, is slated to be the first mining industry witness and will outline the industry's views on mineral policies, as set forth in the Declaration of Policy adopted at Salt Lake City last September.

Several Western Governors are also scheduled to testify on the condition of the mining industry in their particular States. They will also appear in support of a resolution approved by the Western Governors Conference in Colorado Springs recently. The resolution cites the depressed state of the mining industry due to reduced tariffs, increased costs, adequately filled stockpiles, and the adverse effects these are having on the Western States. The resolution asks for joint action by the Administration and the Interior Committees of both Houses to implement a National Minerals Policy without delay. It also urges the House Ways and Means Committee to take whatever steps are necessary to assure that the domestic mining industry retains an adequate share of the domestic market, through tariffs, excise taxes or quotas, or combinations of them.

TRADE HEARINGS CONTINUE

Hearings on the Administration's proposed extension of the Trade Agreements Act continue as both opponents and proponents have appeared before the House Ways and Means Committee advocating their particular point of view. The extension recommended by the President would authorize 25 percent cuts in duties through trade agreements over the next five years.

Under Secretary of Interior Hatfield Chilson testified February 19, saying that those criticizing the Trade Agreements Act among the minerals producing industry point to increased imports and declining domestic output of iron ore, copper, mercury, lead and zinc, and other metals and minerals. Chilson said, "such arguments do not take into account that many of these problems are due to the past years in which we experienced a rapid expansion of demand, followed by the stimulation of increased productive capacity, and then a decline in de-

Washington Highlights

CONGRESS: Begins Easter recess April 3.

MINERALS POLICY: Senate Committee hearings.

TRADE ACT EXTENSION: Under fire.

TARIFF COMMISSION: Minerals studies ordered.

STOCKPILING: Goals almost met.

LAND BILLS: Become active.

PRICE DISCRIMINATION: Measure blocked in Committee.

URANIUM: Producers air plight.

TAXATION: AMC amendment gets support.

mand." He said, "It is difficult, of course, to expect tariff schedules, even with constant adjustments, to stabilize the domestic price in the face of changing economic conditions and marked fluctuations in supply and demand."

S. H. Williston, executive vice president of the Cordero Mining Co., told the committee, "The Reciprocal Trade Act, if extended, would permit still further reduction of tariffs already woefully inadequate and the relief provisions, in previous years held out as relief from these injuries, have already shown themselves quite useless."

Speaking in behalf of the Independent Domestic Fluorspar Producers Association, Clyde L. Flynn, Jr., said that the interests of the country will best be served by Congress regaining its authority over foreign commerce and by exercising a greater degree of control over the protection of domestic industries from ruinous imports. Lunsford Long, president, Tungsten Institute, opposed extension of the Act, saying that today there are only three primary producers of tungsten, all operating at a loss, compared to the 206 properties in this country which produced and sold tungsten in 1956. He said this "unfortunate situation is due to the inadequacy of the tariff on tungsten concentrates and the products made from them when they are processed."

Robert P. Koenig, president, Cerro de Pasco Corp., supported the extension of the Act, saying that any benefits accruing from increases in duties on lead and zinc "would come as windfall profits to low-cost American lead-zinc mine operators."

Dr. C. J. Potter, president, Rochester & Pittsburgh Coal Co., presented the bituminuous coal industry's views on the proposed extension. He said the Act should be amended to provide that imports of crude oil and petroleum products, respectively, be limited to the 1954 relationship of such imports to domestic petroleum demand and that imports in excess of this ratio be deemed to endanger national security. He also urged an amendment providing that whenever the President determines that imports of a commodity shall not exceed specified levels, any company whose imports exceed such levels would be subject to a duty on the excess imports equivalent to 30 percent of the value of the cargo and would be subject to specific penalties, including damages and confiscation of cargo. He asked that the President's authority to enter into trade agreements be extended for only one year, during which time Congress should keep informed on compliance with the Act's national security provisions, with particular reference to energy supplies and resources.

A number of Congressmen also appeared before the committee urging tariff relief for the mineral industries. Speaking for the American Mining Congress, Julian Conover urged specific provisions to provide protection for various segments of the mining industry hard hit by imports of foreign-produced minerals and metals. In particular he called for adequate import excise taxes on copper, lead and zinc, to be imposed when excess imports depress the price below specified "peril points." He also strongly supported the position taken by Dr. Potter as to restrictions on imported residual oil.

The current hearings are expected to conclude late in March and the House Ways and Means Committee may consider the Administration's extension measure in executive session shortly after the Easter recess.

TARIFF COMMISSION STUDIES MINERALS

The Tariff Commission still has before it the petition of the lead and zinc industries for relief under the "escape clause" of the Trade Agreements Act. Rumors are flying about Washington that the Commission's recommendations may be sent to the White House by April 1. Even though the Commission proposes the maximum possible increase in duty, it is generally believed that additional protection will be needed to assure a healthy domestic industry. Some members of Congress are calling for an amendment to the Trade Agreements Act spelling out new import taxes on lead and zinc, to be imposed at suitable "peril points," together with a similar import tax for copper, a mandatory import quota for imported oil, and some tariff relief for other minerals.

Meanwhile the Tariff Commission announced that it has discontinued its study of tungsten costs here and abroad, on the ground that it was unable to obtain adequate data. It had been directed to compare costs of domestic producers with those of foreign producers and report its findings to the Senate early this year. The Senate Finance Committee, obviously displeased with the Commission's action, has approved another resolution directing the Tariff Commission to go ahead with such a study and make its findings known to the Senate by December 1, 1958. A similar resolution was approved for mercury. Senate action on the two resolutions is expected shortly.

STOCKPILE REPORT STUDIED

Gordon Gray, director of the Office of Defense Mobilization, recently made his agency's annual report to a closed session of the Joint House-Senate Committee on Defense Production. Senator Robertson (Dem., Va.), chairman of the committee, reported that a major share of the discussion dealt with the stockpile study completed recently by the Pettibone Committee.

Robertson said, "The test of the success of the mobilization program is whether this program provides for the national defense and national security for a nuclear attack as well as limited scale war." Senator Capehart (Rep., Ind.), a member of the Joint Committee, said present stockpiles for "conventional" emergency needs are in "excellent shape" and "fairly well completed."

At a later hearing before a House Appropriations Committee, Gordon Gray stated that the stockpile goals are two-thirds complete and that out of the 75 materials on the ODM list only nine will be subject of further purchases. These include: amosite asbestos, electrolytic chromium, diamond dies, metallurgical grade fluorspar, jewel bearings, muscovite block mica, muscovite film mica, selenium, and silicon carbide. He also testified that the Government will stop buying lead and zinc "very soon," and does not plan to make any purchases of these two metals in the next fiscal year.

PUBLIC LANDS BILLS ACTIVE

The President has signed into law a bill which requires Congressional approval prior to any withdrawal of public lands totaling more than 5,000 acres for any one Defense Department facility. This measure was staunchly supported by the American Mining Congress and other mining industry organizations.

The law also provides that all military withdrawals, except lands reserved for naval oil or coal, are subject to the condition that all minerals therein are under the jurisdiction of the Secretary of the Interior and must be disposed of under the applicable mining and mineral leasing laws, except where the Secretary of Defense determines that such disposition would be inconsistent with military use of the lands.

A number of proposals dealing with requirements for performance of annual labor on mining claims have been introduced in Congress.

Senators Bible (Dem., Nev.), Murray (Dem., Mont.) and Church (Dem., Idaho) have introduced a bill which would suspend the annual labor requirement for one year for holders of unpatented mining claims. It would require claimants merely to file in the office of record a notice of intention to hold their claims. Sponsors said the bill is an attempt to aid the small miners during the present critical period in the mining industry. The proposal was referred to the Senate Interior and Insular Affairs Committee where no action has been taken.

(Continued on page 96)

personals

Howard S. McCray has been elected chairman of the board of directors and chief executive officer of Texas-Zinc Minerals Corp. and **A. L. Hayes** has been elected president.

Texas-Zinc is jointly owned by the Texas Co. and the New Jersey Zinc Co. and is engaged in uranium exploration and mining in several western states.

H. S. McCray

McCray was manager of Texaco's Purchasing Department at the time of his recent promotion. Hayes, manager of Texas-Zinc Minerals Corp. since 1956, had been employed by New Jersey Zinc since 1927.

Appointments to key positions in two reorganized divisions of the Grand Junction Operations Office of the Atomic Energy Commission have been announced. On January 1, the Production Evaluation Division and the Source Materials Procurement Division replaced the three former operating divisions, the Mining, Exploration, and Concentrate Procurement Divisions.

Arthur E. Granger is the new director of the Production Evaluation Division and **David D. Baker** is deputy director.

Charles E. Tonry was named director of the Source Materials Procurement Division.

Howard I. Young, president of American Zinc, Lead and Smelting Co. announced that **Dale I. Hayes,** assistant to the president, has resigned that position to become vice-president and general manager of Hidden Splendor Mining Co. with headquarters in Salt Lake City, Utah. Hidden Splendor, wholly-owned uranium subsidiary of Atlas Corp., operates extensive uranium mines in Wyoming, Utah, Colorado, and New Mexico.

D. I. Hayes

Hayes has been associated with American Zinc since 1915. He served as superintendent of zinc mining operations in Wisconsin; the lead-silver operations at Neihart, Mont.; zinc-lead operations in Metaline Falls, Wash.; and, later, as western manager of operations. Since August 1955 he has served as assistant to the president.

James M. Knowles, vice-president, Pittsburgh Consolidation Coal Co., and president, Fairmont Supply Co., retired at the end of January after 32 years of service with Pittsburgh Consolidation and predecessor companies.

A. V. Faull has been named superintendent of the mine recently acquired by Crucible Steel Co. of America at Hugheston, W. Va. He had been superintendent of the Crucible mine at Crucible, Pa.

At the same time it was announced that **Frank A. Burns** has been named acting superintendent of the Crucible mine. He formerly was engineer, mining practice, at Crucible.

Charles R. Ince has been elected to the board of trustees of St. Joseph Lead Co. Ince became associated with the company in 1929 and has been a vice-president since 1951.

Guy Browning has resigned as general superintendent of Lorado Coal Mining Co. to resume his association with Robinson and Robinson, consulting engineers of Charleston, W. Va.

The long-time vacancy on the board of trustees of the United Mine Workers of America Welfare and Retirement Fund has been filled by appointment of **Henry G. Schmidt,** president of North American Coal Corp., as operator-trustee of the fund. He was named to succeed the late Charles A. Owen, who served as trustee from 1950 until his death July 20, 1957.

H. G. Schmidt

Two recent changes in the organization of the Oliver Iron Mining Division, U. S. Steel Corp., have been announced. **Fred D. Hoover** is now superintendent of the Gilbert iron mine; and **Donald B. Muckler** has been promoted to assistant superintendent of the Rouchleau mine. Both operations are on the Mesabi range.

U. S. Steel Corp. recently made several far-reaching changes in management personnel.

Following the naming of **M. W. Reed** as executive vice-president—international raw materials, these appointments were made: **James C. Gray,** administrative vice-president—raw materials; **R. M. Lloyd,** administrative vice-president — international and raw materials—staff, and **M. D. Millard,** administrative vice-president —international.

Gray, formerly vice-president—operations—coal, is now in charge of production in mining such raw materials as iron ore and limestone in both domestic and foreign operations. Lloyd's responsibilities are related to service functions in connection with raw materials and international commercial matters. Millard, who was most recently assistant vice-president —sales, American Steel and Wire Division, U. S. Steel Corp., will be concerned with foreign markets and international commercial matters.

J. C. Gray

J. F. Core

Jesse F. Core succeeds Gray as vice-president—operations—coal, and **Elwood B. Nelson** was named assistant vice-president—coal—production. **Woods G. Talman** is assistant vice-president—coal—staff.

Prior to his promotion, Core was general superintendent of U. S. Steel's Frick District. Nelson was formerly general manager of the corporation's coal mining division, and Talman was general superintendent of coal operations in the Gary, W. Va., and Lynch, Ky. districts.

E. B. Nelson

W. G. Talman

R. C. Beerbower, Jr. was appointed general superintendent, Frick District, succeeding Core. He formerly was assistant general superintendent. **W. E. Cook** was named assistant general superintendent of the Frick District in charge of the Robena mines, and **J. B. Girod** was named assistant general superintendent, raw coal mines, in the Frick District.

G. L. Jordan is now assistant general manager of National Potash Co. Jordan joined National Potash in 1954 at the start of construction of the company's plant at Carlsbad, N. M. He served as chief engineer during the construction period and became refinery superintendent when the plant was put into production a year ago.

James D. Moore, chief process engineer, has been promoted to production manager of Vitro Uranium Co. He will be responsible for all plant operation, engineering and maintenance and process research and development.

E. Warren Peterson, superintendent of the Sherwood iron mine of Inland Steel Co., has taken over new duties as mechanical superintendent of Inland's iron mining subsidiary, Caland Ore Co., Ltd.

Recent announcement has been made of the appointment of **H. Z. Stuart** as manager of exploration for Phelps Dodge Corp. Stuart has been resident engineer of mines for Phelps Dodge in New York.

Robert D. Fisher, a vice-president of the University of Southern California, has been named vice-president of Cyprus Mines Corp.

John H. Mathis, vice-president and secretary of Lone Star Cement Corp., has been elected a director of Inspiration Consolidated Copper Co.

Lemoyne C. Olson, operating engineer at the Armour No. 1 iron mine of Inland Steel Co., has been promoted to assistant superintendent of the Armour No. 1 mine.

W. P. Schrinner is now assistant engineer of Pocahontas Land Corp.

E. A. Schroer, mill superintendent of the Chino Mines Division of Kennecott Copper Corp., retired January 1—35 years after he first joined Chino. He had served as mill superintendent since 1948.

Norman A. Moberg is now director of mineral development for the Oliver Iron Mining Division of U. S. Steel Corp. He will be in charge of exploration, acquisition and development of the division's mineral properties.

Hugo Korpinen has resigned as superintendent of underground iron mines of the Cleveland-Cliffs Iron Co., Marquette iron range.

George H. Beehler, general manager of Glen Alden Corp., is the eighth chairman of the anthracite board of conciliation. He succeeds **Evan Evans.**

Richard B. Nelson recently joined International Minerals & Chemicals Corp. as mine project engineer at Carlsbad, N. M. Nelson most recently had been employed by the Hidden Splendor Mining Co., at Moab, Utah.

T. V. Davis was recently named superintendent of the Penn-Dixie Cement Corporation's plant at Richard City, Tenn. He succeeds **A. E. Legg** who retired after 49 years of service to Penn-Dixie and its predecessor companies.

Davis joined the cement company in 1951 as plant engineer at Richard City.

Domenic Stanchina has succeeded **Harry Dusz** as chief inspector of the Ohio Division of Mines. Before joining the Ohio Division of Mines 16 years ago, Stanchina was a mine foreman with Hanna Coal Co.

Promotion of four engineers at Vitro Uranium Co. mill at Salt Lake City has been announced.

M. T. Ellis was named operations superintendent; **T. G. Rukavina** was promoted to plant engineer in charge of engineering and maintenance, and **G. W. Hansen** was named chief chemist. **L. D. Lash** was named metallurgical engineer.

Augustus C. Long, chairman of the board of directors and chief executive officer of the Texas Co., has been elected a member of the board of directors of Freeport Sulphur Co.

Richard T. Todhunter, Sr., has retired as president of Barnes & Tucker Coal Co. at Barnesboro, Pa., rounding out nearly 70 years in the coal industry. He has held virtually every position in coal mining since beginning his career as a trapper boy at the age of 12.

With Barnes and Tucker since 1946, he will be retained by his company as a consultant.

The directors of Zonolite Co., engaged in the mining and manufacturing of vermiculite, have elected **J. A. Kelley** president. Kelley was responsible for the development of the firm's extensive mining and milling enterprises in South Carolina.

J. W. Krous, former general superintendent of mines for Imperial Coal Corp., has been named to the newly-created position of executive vice-president of that company.

William M. Kirkpatrick has been appointed western general counsel of the Anaconda Co. He succeeds **James T. Finlen,** the company's western general counsel since 1952, who resigned effective February 28.

William M. Kirkpatrick

From 1937 until 1940, Kirkpatrick, a native of Butte, was a legal counsel for Anaconda at its Butte offices. During the years 1940-42, he was Chicago counsel for the company with offices in that city. Following World War II, Kirkpatrick returned to Butte as a legal counsel for Anaconda, a position he has held to date.

Clarence A. Keeley has been elected treasurer of Universal Atlas Cement Co. He succeeds **Thomas E. O'Connor** who retired January 31 after 37 years of service with Universal Atlas.

Brower Dellinger, formerly mill manager at the Monticello uranium mill of National Lead Co., has been named assistant plant manager for National Lead at its titanium mine and plant at Tahawus, N. Y., He has been succeeded at Monticello by **George K. Coates,** formerly general superintendent there.

Paul V. Williams has been appointed underground mine foreman at the Iron Mountain, Mo., Mines of Ozark Ore Co.

Jim Kosheny, foreman at the Georgetown preparation plant of Hanna Coal Co., has been promoted to superintendent of the new Ireland preparation plant.

— *Obituaries* —

Edward Hopkins Emerson, 80, retired mining engineer died in New Rochelle, N. Y. February 26.

Formerly a president of the Cuba Copper Mining Co. and the Phoenix Mines in Cuba, Mr. Emerson had been a partner in a consulting mining engineering firm in New York.

Guy H. Riblett, 73, chief estimator for the Fairmont Machinery Co., died January 26 in Fairmont.

Edward J. Fearing, retired general superintendent of iron mining for Pickands Mather & Co., died February 18 in Minneapolis, Minn.

John J. Oberbillig, pioneer Idaho mining man, died January 7.

President and general manager of the United Mercury Mines at the time of his death, Mr. Oberbillig had been identified prominently with the mining industry of Idaho. His particular field was the Yellow Pine mining district, and many of the roads and improvements in that area were due directly to his efforts.

Lester C. Smull, vice-president of Riverside Cement Co., Division of American Cement Corp., passed away January 16.

NEWS and views

Coal Pipeline Nears Commercial Basis

Pittsburgh Consolidation Coal Co. expects the operation of its coal pipeline to reach a commercial basis within the next 90 days. This was revealed March 10 in a progress report to company officers by James Hyslop, president of Pitt Consol's Hanna Coal Company Division.

The world's first cross-country coal pipeline—which stretches 108 miles from the coal company's Georgetown Preparation Plant near Cadiz, Ohio, to the Eastlake power station of Cleveland Electric Illuminating Co.—has been in partial operation and under test since April 1957.

Hyslop reported that in recent months the line has operated for continuous runs as long as three weeks, with maintenance shutdowns of from two to 48 hours.

When in commercial operation, the line is expected to deliver 1,200,000 tons of coal to the Eastlake terminal annually.

Explaining the lengthy test period needed to assure trouble-free operation of the pipeline, Hyslop said: "The pipeline itself and the related high pressure pumping equipment have proved entirely successful from the start. Our problems have centered mainly around preparation of the slurry, with some difficulty in the drying operation.

"The preparation problems have been intricate. This was true particularly of the operations involved in grinding and screening, and in under water coal storage and recovery. At the discharge terminal, less serious problems were encountered in slurry dewatering.

"While the solution of these problems has consumed more time than originally anticipated, there was never any question about the achievement of ultimate success and the demonstration that coal pipeline transportation is practical."

Asarco, Kennecott Sign Contract

A modified and extended contract for the refining of Kennecott copper at the Baltimore refinery of American Smelting and Refining Co., was recently announced by J. D. MacKenzie, vice president of Asarco.

The contract covers a 5½-year period beginning July 1, 1960. Asarco will refine a minimum of 6000 and a maximum of 8000 tons of copper per month from the domestic mines of Kennecott Copper Corp.

Capacity of the Baltimore refinery of American Smelting is 16,500 tons, according to MacKenzie. Until mid-1960 this will all remain available to Kennecott. Thereafter, the modified contract leaves a minimum of 8500 tons per month of copper refining capacity available to Asarco. This capacity, plus Kennecott's own $30,000,000 refinery now under construction in Anne Arundel County, Md., eases a developing squeeze on copper refining capacity on the East Coast. The Kennecott plant will have an initial capacity of 16,500 tons a month and is expected to be in operation in 1959.

New mines in Arizona and Peru, and Kennecott's decision to refine electrolytically additional quantities of its formerly fire-refined copper, will add considerably to the load on U. S. refineries in the next few years. MacKenzie pointed out that production from Southern Peru Copper Corp., the big mine and smelter development in Peru, which is majority owned by Asarco, will be coming into production in 1960. Southern Peru is expected to produce 120,000 tons of blister copper annually.

Electricity—Major Soft Coal Market

Electric utilities grew as the major bituminous coal market in 1957, according to the U. S. Bureau of Mines. During last year the electric utilities industry used a total of 162,000,000 tons of coal. That number compared with 86,000,000 tons in 1947 and 115,000,000 tons in 1956. The steel and coke industries used 110,000,000 tons of bituminous coal, showing a decrease of 5,000,000 tons from ten years ago. A total of 111,000,000 tons of coal was used in the production of steel and coke during 1956.

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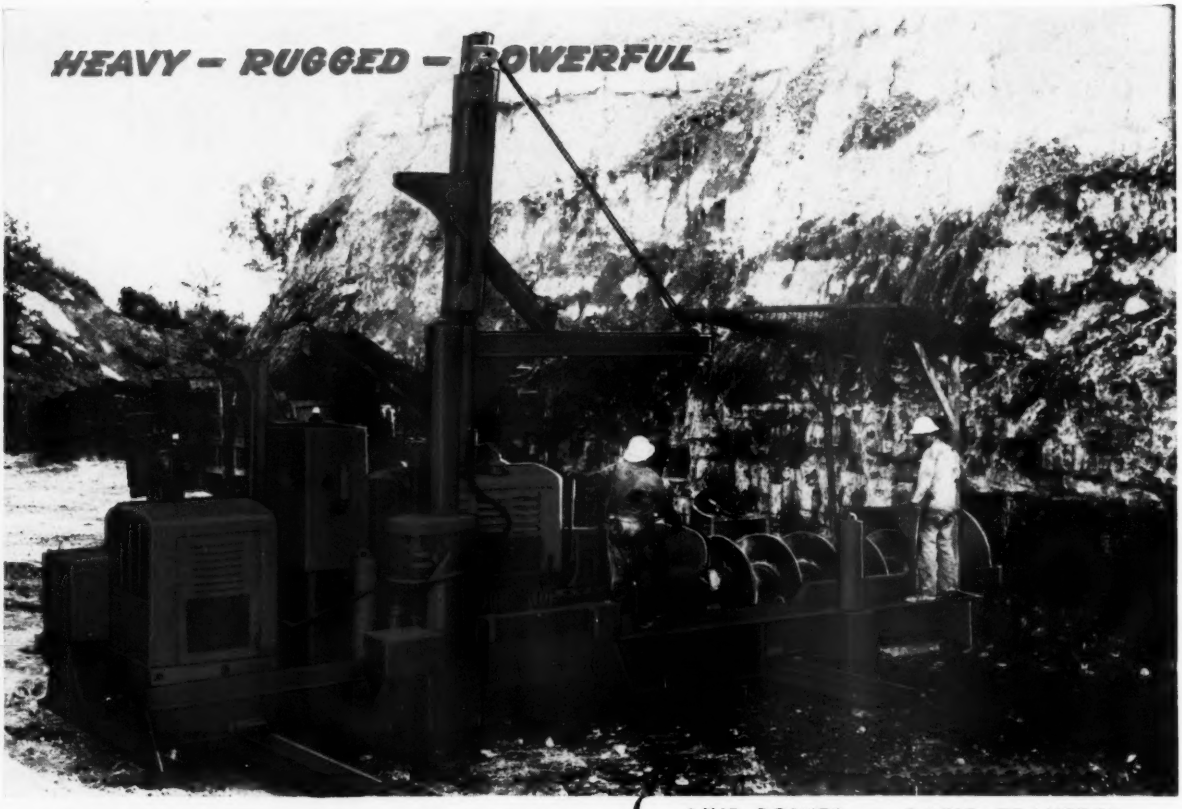

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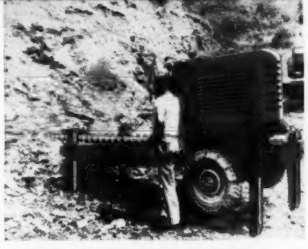

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Alumina from Low Grade Ores

The North American Coal Corp. of Cleveland and Strategic Materials Corp of Buffalo recently announced a joint venture operation under the name Strategic North American Corp., for the purpose of developing and exploiting a new process for recovery of high grade alumina from low grade ores and coal mine wastes. The joint venture corporation is empowered to build and operate plants for the production of alumina and aluminum sulphate and to license the process.

North American Coal has extensive reserves throughout the Ohio River Valley. The joint venture is a further attempt by NACCO to eliminate the waste piles of reject material from its coal mining and coal cleaning operations. The combination of available raw materials, low cost fuel for power and closeness to major markets has important economic possibilities. Continued research and pilot plant work will be conducted at Strategic's laboratories in Niagara Falls, N. Y., to provide design and operating data for a commercial plant. Proposed location for the first commercial plant is at North American's Powhatan mines on the Ohio River.

The basic process, which utilizes an acid-leaching technique, was originated by Dr. Marvin J. Udy, well-known metallurgist, and his son, Dr. Murray C. Udy, both of whom are associated with Strategic Materials Corp. The Strategic-Udy Process can use domestic raw materials high in iron and silica. High grade alumina has been made in the laboratory from coal mine wastes by this process. Although many acid processes have been proposed in the past, none has been commercialized because of high costs and the poor quality of the product. The Strategic-Udy Process eliminates two of the high cost steps in other acid processes and produces alumina of high purity. Strategic Materials Corp. and its subsidiaries have large reserves of manganese, chromium, copper-nickel and other ores in Canada and, in addition to the aluminum process, have developed several processes of recovering valuable minerals from low grade ores. They are currently working with Koppers Co., Inc. of Pittsburgh, Pa., in developing engineering and economic data for all projected commercial operations.

Pitt Consol Producing Chemicals

The Mountaineer Carbon Co., a subsidiary of The Pittsburgh Consolidation Coal Co., has begun operations at Cresap, W. Va., to produce calcined carbons for use in the aluminum industry and other refined carbons for electrometallurgical and chemical industries. The plant will use heavy oil and chemical products from coal to produce the carbons.

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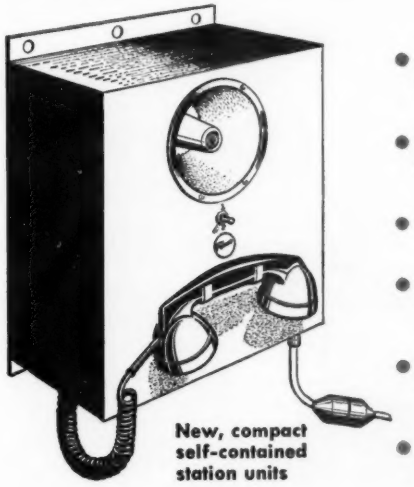

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WHEELS OF GOVERNMENT

(Continued from page 90)

Another bill of interest is that introduced by Senator Barrett (Rep., Wyo.). It would suspend annual assessment work requirements as to valid mining claims located on or before the date of enactment for the development and production of fissionable source material. The suspension would remain in effect until the end of the assessment work year during which the Secretary of the Interior, after consultation with the AEC, determines that market conditions for fissionable source materials justify further development of such mining claims. The bill has likewise been referred to the Senate Interior Committee.

A third measure, introduced by Senator Church (Dem., Idaho), would change the assessment work year from July 1-June 30 to August 15-August 15. This measure will be considered at early hearings of the Senate Interior Committee.

PRICE BILL CONSIDERED

The Senate Judiciary Committee gave formal consideration to the so-called price discrimination bill (S. 11) recently, but did not vote on whether to report the bill to the Senate floor. Introduced by Senator Kefauver (Dem., Tenn.), this measure would seriously limit the right of a seller to meet the equally low price of a competitor and would cast serious doubt on the legality of freight absorption to meet competition. It has been consistently opposed by the mining and other basic industries.

It is reported that the actual committee vote was blocked by Senator Dirksen (Rep., Ill.), who is opposed to the bill. Dirksen is believed to have enough votes to get approval of substantive amendments or to keep the bill "bottled up" for a time. Advocates of the proposal will continue to seek favorable action by the Judiciary Committee.

DOMESTIC URANIUM PLIGHT AIRED

The plight of the domestic uranium producer was outlined to the Joint House-Senate Committee on Atomic Energy recently, as Western mine and mill operators, State officials, and members of Congress urged greater milling capacity, renegotiation or cancellation of foreign contracts for uranium, the possible use of stockpiling, and greater liaison between uranium producers and the Atomic Energy Commission.

The hearings, which were devoted to the state, growth and development of the atomic energy industry, emphasized that the curtailment of purchases of concentrates by the Atomic Energy Commission last fall had seriously hurt many prospective producers having no established market for their product.

Witnesses deplored the lack of milling facilities in many areas. They said the AEC's decision to enter into no new contracts for the construction of such facilities left many of the producers with ores which they are unable to get processed. Wyoming witnesses pointed out that new areas, rich in uranium ore, have been discovered and mining started, but that available milling capacity is not nearly sufficient to take care of the ore produced.

Senator Barrett (Rep., Wyo.) urged the construction of such additional milling capacity and said the Government is morally obligated to the industry because of past urgings to develop resources for sale in a guaranteed market. He also asked for a temporary stockpile which would be fed back into the market after current foreign contracts for uranium have expired. Testimony supporting increased milling capacity was also presented by Senators Allott (Rep., Colo.), Carroll (Dem., Colo.), Mundt and Case (Reps., S. Dak.) and Young (Rep., N. Dak.), and Representatives Montoya (Dem., N. Mex.), Thomson (Rep., Wyo.) and Berry (Rep., S. Dak.).

Senator Watkins (Rep., Utah) urged a stockpile of concentrates while Miles P. Romney, manager, Utah Mining Association, urged open markets for the domestic industry, no renewal of foreign contracts, greater liaison between the AEC and producers, a stockpile, greater consideration by the mills of custom shippers and the establishment of an official purchase program. Robert S. Palmer, executive vice president, Colorado Mining Association, told the Committee early remedial action by the Government would be required to save the industry.

Clark L. Wilson, vice president, Northwest Uranium Mines Inc., pointed out that his company had a mill construction contract pending with the AEC at the time the curtailment was announced. He said that in spite of the fact the Commission had said such contracts would be honored, the AEC has refused permission for the construction of the mill.

Gordon Weller, executive vice president of the Uranium Institute of America, emphasized the need for greater liaison between the uranium

(Continued on next page)

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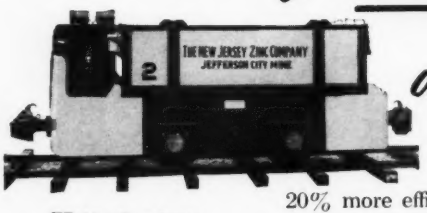

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(Continued from previous page)

producer and the AEC, and suggested the establishment of an Atomic Industry Evaluation Council to meet this need.

Appearing for the coal industry, Kenneth A. Spencer, president, Pittsburg & Midway Coal Mining Company, said the coal industry has favored a reasonable and orderly research and development program for civilian atomic energy to demonstrate whether it is economical, together with the providing of assistance to foreign nations having power shortages. He pointed out, however, that there is no immediate need for a domestic nuclear power program in view of the availability of ample coal supplies and continuing improvement in the efficiency of coal-derived power.

Spencer suggested this three-point program for development of commercial atomic energy: (1) give the domestic atomic energy industry more authority to handle its own affairs; (2) have the AEC sanction the building of large-scale reactors to improve technology and not for stimulating the economy; and (3) permit the atomic energy industry to compete in foreign markets.

AMC PROPOSES TAX AMENDMENT

Lincoln Arnold, chairman of the Tax Committee of the American Mining Congress, appeared before the Senate Finance Committee February 27, urging that the Committee amend the Internal Revenue Code to restore to the extractive industries those rights with respect to determination of "property" for depletion purposes which were inadvertently removed by Section 614 of the 1954 revision of the Code.

The Committee hearings were on the Mills bill, H. R. 8381, which has already passed the House and is intended to remove unintended hardships and benefits arising out of the 1954 revision. Arnold said Section 32 of the Mills bill, as passed by the House, provided some relief from the 1954 action, but that unless the bill is amended in the Senate to spell out the rights of the taxpayers in determining the depletion unit, taxpayers may be forced to the expense of considerable litigation.

Arnold urged that the taxpayer be authorized to elect to treat each mine as the depletion unit under all circumstances, and that the taxpayer have the right to wait until he makes expenditures for development or operation before being required to make his election with respect to given acquisitions. He also said that "operating unit" should be defined in the law with a presumption of correctness being given to the taxpayer's determination of what constitutes an operating unit. Arnold also said that royalty owners should be permitted to aggregate their properties in the manner which was permitted under the administration of the law prior to 1954.

The recommendations made by Mr. Arnold were discussed at length with the Committee and Senator Bennett (Rep., Utah) offered an amendment embracing the proposals of the American Mining Congress. The Bennett amendment was also supported by Richard Hershberg for the National Coal Association, J. M. B. Lewis for the National Council of Coal Lessors Inc., and Roland G. Smith for the American Iron Ore Association.

Also in the field of taxation, several Senators have suggested an amendment to repeal the excise taxes on transportation, which currently are three percent on freight, four cents per ton on coal and ten percent on persons. They propose to amend a bill dealing with excise taxes which passed the House last year and is currently before the Senate Finance Committee.

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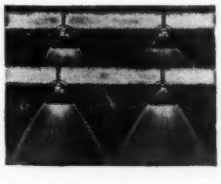

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Coal Producers Plan for Export Promotion

An export trade corporation under the name High Volatile Coal Export Association, Inc., has been formed under the Webb-Pomerine Export Trade Act. The act, which is administered by the Federal Trade Commission, provides exemption from antitrust laws for associations of domestic producers organized solely for joint dealings in export trade. High volatile coals, those containing 28 percent or more of volatile matter on a dry-weight basis, are used principally for coking and steam production. Joseph E. Moody of Washington, D. C., who is president of the Southern Coal Producers Association, was elected president of the high-volatile group.

A similar association of low-volatile producers, called Low Volatile Coal Exports, Inc., was formed earlier to promote the export sale and service of low volatile coal and to stabilize its overseas markets. This group has agreed to attempt to standardize classification and pricing; assemble and distribute information on foreign market requirements, import quotas, tariffs and other data relative to promotion of foreign sales. Warren F. Letherman, president of Crozer Coal & Land Co., and Page Coal & Coke Co., Philadelphia, Pa., has been elected president.

Commercialores to Mine Kyanite

A kyanite mine will soon go into operation on the southern edge of Crowders Mountain, near Gastonia, N. C. It will be opened by Commercialores, Inc., a firm already mining kyanite at Henry's Knob near Clover, S. C. The Leventis-Petchios-Trakas Corp., which owns Crowders Mountain and the land around, leased 300 acres to Commercialores.

Kyanite is a mineral used in the manufacture of porcelain bath and kitchen fixtures, fire brick, wall tile and various ceramics.

Mine to Tap 15,000 Acres of Pittsburgh Seam Coal

United States Steel Corporation's multi-million-dollar Maple Creek Mine, located at New Eagle, Washington County, Pa., is expected to go into production next year. Annual output should reach 500,000 tons of mine-run coal by the end of 1959. The Clairton coke plant will be the coal facility's principal consumer.

A tipple will be built along the Monongahela River near the mouth of the mine. A trestle and conveyor system serving the tipple will cross Route 88 at New Eagle.

Over-all plans call for the installation of a personnel service shaft, modern harbor facilities for barge loading on the Monongahela River, surface shop facilities and a rock slope for handling supplies and equipment.

Maple Creek Mine will tap a reserve area of some 15,000 acres of Pittsburgh seam coal. The tract is U. S. Steel's last major undeveloped field in Pennsylvania.

Gypsum-Ore Hauling Contracts Signed

The National Gypsum Co. has signed a ten-year contract with Boland & Cornelius, Buffalo lake-vessel operators, to transport gypsum ore from National's gypsum quarry in northern Michigan to its new plants at Waukegan, Ill., and Lorain, Ohio.

Shipments will start from National Gypsum's new Tawas City, Mich., gypsum quarry next fall to the Waukegan gypsum-products plant, which will be brought into production in the spring of 1959. The early date for the gypsum shipments is necessary to create a gypsum-ore stockpile.

Initial work is under way for the construction of the $7,500,000 Waukegan plant, and the Tawas City quarry operation is being built. The latter will include a steel and concrete dock extending half a mile out in Lake Michigan. The $7,500,000 Lorain plant will be in production in the spring of 1960. The two plants will require a total of about 600,000 tons of gypsum ore per year.

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America's Largest City Hosts AIME Annual Meeting

New York City was the site of the annual meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers, February 16-20. Engineers from all over the world were on hand to attend the technical sessions, enjoy the city's many attractions and take in the convention's social activities.

Grover J. Holt, 1957 president of the Institute, presided over the convention, turning the gavel over to Augustus B. Kinzel, the new president, at the annual banquet. Kinzel, vice-president—research, Union Carbide Corp., is one of the country's leading research metallurgists. His contributions and publications cover a wide range of activities in metallurgy, applied mechanics, nucleonics and industrial gases.

As in previous years, AIME took the opportunity afforded by its national meeting to honor members who had rendered conspicuous service to the industry. For outstanding achievements and professional contributions, three eminent engineers were elected to Honorary Membership, the highest distinction conferred by the Institute. This honor went to Dr. Champion Herbert Mathewson, professor emeritus of metallurgy and metallography at Yale University; Donald Hamilton McLaughlin, president of Homestake Mining Co., and Fred Searls, Jr., chairman of the board of Newmont Mining Corp.

Among the other honors conferred was the presentation of the Hoover medal to Scott Turner, former director of the U. S. Bureau of Mines, for preeminent service in advancement of the well-being of mankind. Dr. Turner is one of the five men who prepared Canons of Ethics in Engineering. J. Roy Gordon, executive vice-president of International Nickel Co. of Canada, Ltd., received the James Douglas gold medal for distinguished contributions to process metallurgy in the field of smelting and refining of nickel and metallurgical improvements in nickel recovery.

The Charles F. Rand gold medal went to John F. Thompson, chairman of International Nickel Co. of Canada, Ltd., for distinguished achievement in mining administration. Fred D. De Vaney, director of metallurgy and research, Pickands Mather & Co., received the Robert H. Richards award for his contributions to grinding, concentrating and pelletizing, and for his direction of research, metallurgical engineering and development of methods for taconite beneficiation.

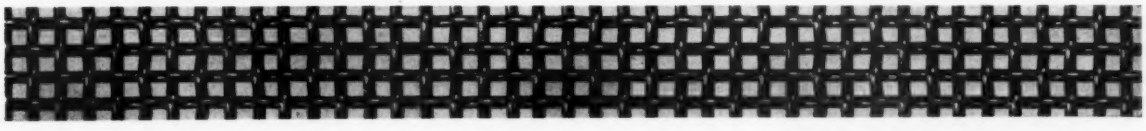
Abbott H. Shoemaker, vice-president and general manager of all mining operations of Homestake Mining Co., delivered the Jackling lecture, "Planning for Deep Mining at Homestake," and received the Daniel C. Jackling award for leadership in efficient mine operation. The William Lawrence Saunders gold medal was awarded to William Jesse Coulter, retired, for his distinguished achievement in contributing in general to the success of Climax Molybdenum Co., and in particular for developing mining practices of the Climax Mine.

It was a highly enjoyable as well as informative meeting, with keen interest shown in the excellent papers presented at the technical sessions of the various societies.

Hanna to Tap Brazilian Iron Reserves

The M. A. Hanna Co. of Cleveland, Ohio, through its subsidiary, Hanna Coal and Ore Corp., has acquired together with Leo Model of New York, and associates, the controlling interest in St. John d'el Rey Mining Co. This 125-year-old British company is engaged in gold mining operations in Brazil and has substantial land holding believed to contain large tonnages of iron ore.

Plans have been perfected to send to Brazil a group equipped with large-scale prospecting and drilling equipment to investigate the gold properties, to fully explore the iron ore reserves and to make detailed studies of the transportation of iron ore and dock facilities.



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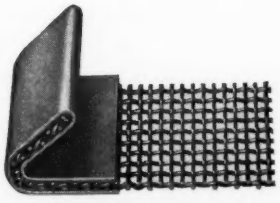

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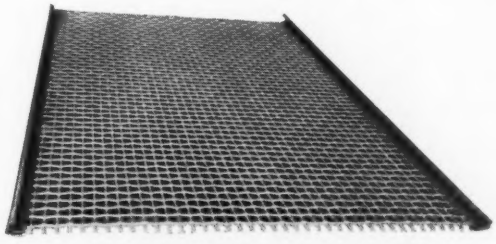

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Lead, Zinc Meetings

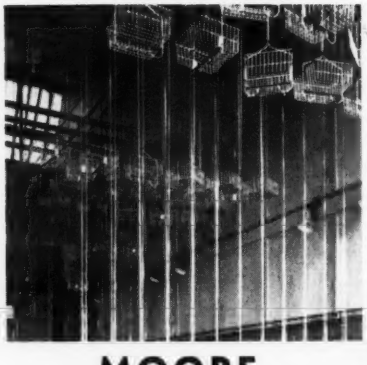
The American Zinc Institute, Inc., and the Lead Industries Association will hold their annual meetings at the Chase-Park Plaza Hotels, St. Louis, Mo., on April 14-15 and April 15-16, respectively. A joint session will be held on April 15 at which plans for research programs on lead and zinc will be discussed as will the outlook for world lead and zinc production and consumption. Other sessions will be devoted to the two individual metal fields.

EGFA Establishes Long-Range Planning Group

The Coal Division of Eastern Gas and Fuel Associates has announced a reorganization of its headquarters engineering department to separate the handling of special and long-range problems from the detailed engineering problems which arise daily.

Initially the department will consist of six sections: mine engineering; preparation; property; electrical; ventilation and shaft sinking and repairs. Stephen Krickovic, formerly chief engineer, is in charge of the department as director of engineering and development. E. B. Taylor, formerly assistant chief engineer, is in charge of the mine engineering section.

OVERHEAD STORAGE



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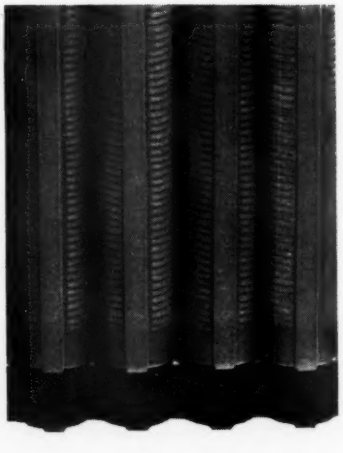

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NEWS and views

Coal Big Factor in Electric Expansion

Utah Power and Light Co. announced it would go ahead with a $34,000,000 investment in steam electric generating facilities in the coal-rich Kemmerer area of southwestern Wyoming. The program, under research and development for 18 months, eventually will call for establishment of two more units, bringing ultimate generating capacity of this northern point of the utility's system to 345,000 kw.

The project consists of the generating plant adjacent to the coal fields of Kemmerer Coal Co., a 42,000-acre reservoir on Hams Fork River, necessary piping facilities to supply water for plant cooling and a 100-mile, 230,000 volt transmission line addition to the Ogden area of UP&L service.

Kemmerer Coal Co. will develop open pit mining of coal at its properties, and will supply more than 500,000 tons yearly to Utah Power under a long-term contract. The coal firm has allocated 35,000,000 tons of coal to the operation of the plant. Annual fuel cost is placed at $2,400,000.

Utah Power announced that a prime consideration in locating the plant near Kemmerer was available water and coal supplies and the need of additional capacity on the north end of its system serving southwestern Wyoming, southern Idaho and northern Utah.

San Francisco Mining Show
Program Preparations Underway

Under the distinguished leadership of Frank Coolbaugh, vice-president of Western Operations, Climax Molybdenum Co., the state and district chairmen of the National Program Committee are going to work in earnest to develop an outstanding program for the American Mining Congress Convention and Exposition to be held in San Francisco, September 22-25.

With new developments all along the line in both industry policy and operating technology, and with trouble spots in some areas, there is no lack of material to be crammed into the four days of convention sessions.

The committee has taken on the man-sized job of picking the best-qualified speakers to bring the full story of the status and progress of mining to convention-goers next fall. National mineral policies, tariffs, taxation, safety, labor relations, public lands problems and other matters of Government policy will receive close attention. And the operating sessions will set forth authentic information from men in the field on exploration, underground and open pit practices and mineral beneficiation, in both metal mining and industrial minerals production.

Don't forget, this is an equipment exhibition year, and plans already laid by exhibiting manufacturers make it clear that the show will surpass even the high standards of past A. M. C. Expositions. Careful observation of the mining machines and supplies on display will provide a "refresher" and advanced course in mining equivalent to months of formal study.

Now is the time to make your plans to attend. Requests for hotel reservations should be addressed to the AMC Housing Bureau, Room 300, 61 Grove Street, San Francisco 2, Calif. Processing of these requests will begin in May and the first assignments of accommodations will be made in June.

Program Committee

National Chairman: FRANK COOLBAUGH, Vice-Pres., Climax Molybdenum Co.

STATE AND DISTRICT CHAIRMEN

Alaska: HAROLD STRANDBERG, Pres., Strandberg Mines, Inc.
Arizona: WESLEY P. GOSS, Pres., Magma Copper Co.
California: PETER JORALEMON, Consulting Geologist
Idaho: E. B. DOUGLAS, Mgr., Howe Sound Co.
Montana: E. I. RENOUARD, Mgr. of Mines, The Anaconda Co.
Nevada: J. C. KINNEAR, JR., Gen. Mgr., Nevada Mines Div., Kennecott Copper Corp.
New Mexico: EARL H. MILLER, Vice-Pres., United States Potash Co.
Oregon: HOLLIS M. DOLE, Director, Oregon Dept. of Geology & Mineral Industries
South Dakota: JAMES O. HARDER, Mgr., Black Hills Operations, Homestake Mining Co.
Texas: R. E. CALHOUN, Western Mgr. of Mines, American Zinc, Lead & Smelting Co.
Utah: NORMAN WEISS, Milling Engr., American Smelting & Refining Co.
Washington: E. K. BARNES, Pres., Northwest Mining Association
Wyoming: ROBERT W. ADAMS, Pres., Western Nuclear Corp.
Lake Superior District: R. W. WHITNEY, Vice-Pres., M. A. Hanna Co.
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And machine users get the same swift service if they ever need a replacement Timken bearing. Even for old machines, they can almost always count on immediate delivery of Timken bearings for replacement.

Why not call on our engineers for help whenever you have a bearing application problem or requirement? Timken is your No. 1 bearing value. Wherever wheels and shafts turn, Timken bearings eliminate friction, cutting wear and maintenance to a minimum. Specify bearings trade-marked "Timken" for the machines you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable: "TIMROSCO".

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Symposium on Mine Stope Fill

The Department of Mining Engineering at Montana School of Mines, assisted by the Mining Association of Montana, the Anconda Co., A.I.M.E. and the Montana Society of Engineers will sponsor a symposium concerned with the hydraulic emplacement of mine stope fill. The symposium will be held on the campus of the School of Mines on May 9 and 10, 1958.

The object of the symposium will be to allow some mine operators to present papers outlining their solutions to specific problems in the use of hydraulically emplaced fill. Other operators will explore for solutions to their own problems. The papers will provide as complete a coverage of the most recent developments in the field as time will allow.

There will be sessions covering the use and application of hydraulic fill in new mining methods, as a tool for fighting mine fires, and as a stabilizing factor to combat subsidence. The problems associated with conditioning sand and tailings for the most efficient handling, and results of research into the design of sand fill systems will be discussed.

$225,000 Rod Mill

An experimental rod mill is being installed at the Arthur ore concentrating mill of the Utah Copper Division of Kennecott Copper Corp.

The $225,000 mill is expected to undergo initial tests early this year. Rod mills have proven effective at other copper properties and there are indications that their operating costs may be lower at the Utah property. Because of the size of the experimental rod mill, it was necessary to assemble the mill first and work is now underway to construct a building around it. The mill will be charged with rods 16 feet long and three inches in diameter.

Asphalt Rock Found to Contain Uranium

Significant amounts of uranium have been found in the ash of oil extracted from asphalt-bearing rock in Western states. The U. S. Geological Survey made an examination and appraisal of asphalt-bearing rock in 45 areas in California, Utah, Wyoming. Montana, New Mexico, Texas, Oklahoma, and Missouri on behalf of the Raw Materials Division of the Atomic Energy Commission. Uranium in the ash of oil extracted from the rock was found in seven of the areas tested—Chalone Creek, McKittrick, Edna and Los Alamos, Calif.; Vernal, Utah; Sulphur, Okla.; and Ellis, Mo. All except the Chalone area contain large estimated reserves of asphalt- bearing rock.

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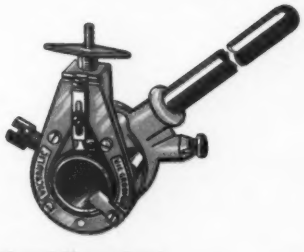

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Barite Attracts Metal Miners

The Bunker Hill Co. of Kellogg, Idaho, has a 25 percent interest in a barite processing plant scheduled to start production next fall. The Sherwin-Williams paint company is building the plant at Coffeyville, Kans., to produce high grade barium monohydrate by a new process.

Another Coeur D'Alene metal producer, Sunshine Mining Co., will develop the Stevens county barite holdings of North Star Uranium, Inc.

A new and significant use now has been reported for barite. It is said to be in growing demand by the paint industry because it provides protection from atomic rays.

Lead-Zinc Research Program

American lead and zinc producers are joining with world-wide lead-zinc industry interests on a broad program of expanded research activities aimed at the consolidation and expansion of existing markets and the development of new ones, according to John L. Kimberley, executive vice president of the American Zinc Institute, Inc.

Extensive plans are now being formulated to sponsor and stimulate both applied and fundamental research on both metals, he said in the organization's annual review of the zinc industry for 1957.

A staff to supervise the new program expansion is now being formed and the next step will be the broad placement of various research-development projects in research centers, universities and engineering schools. Both foreign and domestic producers will participate in financing and supervising the program.

Uranium Mills Begin Operations

Four new uranium mills recently went into operation, another has been planned, and one of the oldest closed.

Texas-Zinc Minerals Corporation's new mill in Mexican Hat, Utah, near Monument Valley, has a present production capacity of 800 tpd. The installation processes ore from about 25 uranium mines in the area. One of the mines served by the mill is the rich Happy Jack uranium mine in White Canyon, also owned by Texas-Zinc.

Gunnison Mining Company's mill in Gunnison, Colo., processes 200 tpd. Ore for the mill comes from the Thornburg mine near Cochetopa Pass. The owners expressed enthusiasm over early results from one unique feature—the mill is built of wood. The wood is more resistant to acid fumes than metal.

The Homestake-New Mexico uranium mill near Grants, N. M., has a capacity of 750 tpd and operates from ore received from Homestake Mining Co. and Rio de Ore Uranium Mines, Inc.

Lucky Mc Uranium Co. placed its mill on stream at the Gas Hills District of Wyoming. The mill will handle 750 tpd from the company's open-pit mines.

Arrangements have been completed privately with banking and financial institutions for the construction of the Kermac Nuclear Fuels Corporation's processing uranium mills and mines in the Ambrosia Lake area of New Mexico. Kermac has a contract with the Atomic Energy Commission to deliver $300,000,000 to $350,000,000 of uranium oxide from this mill through December 31, 1966. The new mill will be the largest of its kind in the United States; capable of processing over 3500 tpd.

Vanadium Corporation of America will no longer operate its uranium mill at Naturita on the Colorado plateau because the mill is obsolete. The mill—one of the oldest continuously-operated processors in the west—could not compete with modern milling operations.

Copper Ore Process

Gus F. Ingwersen of Denver, Colo., has been experimenting with a new process of extracting copper from some ores at his copper mine and ten tpd testing plant about 14 miles southwest of Bluewater, in the Grants, N. M., area. This process reportedly does not require what is regarded as fine grinding and consists of leaching with slow, constant agitation. The resultant product, after precipitation and hydrogenation, is said to consist of pure copper in particles practically as fine as flour. Should the copper ore contain other metals, according to Ingwersen, these are extracted and can be saved independently. Patents for the continuous flow process have been applied for.

Ingwersen's operations in the Grant's area are carried on under the name of the Grants Mining & Leaching Corp.

Aluminum—Supply Catches Demand

The aluminum industry, after five straight record years, has finally caught up with the demand for its product and the result has caused some producers to temporarily reduce production.

Probably one of the first indications of what lay in store for aluminum producers was the 25 percent cutback by The Anaconda Co. in May 1957. For the first time in a decade a producer shut down its pot lines because of an over-supply. Alcoa, Kaiser, and Reynolds, however, had Korean War contracts whereby the Government was committed to buy surplus metal for the stockpile, and along with Ormet Corp. and Harvey Aluminum planned considerable expansion of production capacity.

In September, the Government contracts were revised to the effect that domestic producers must subtract their imports (Alcoa and Kaiser had long-term contracts signed in 1953, when aluminum was in short supply, with Canadian producers) from the amount they are entitled to sell to the Government.

A four-month strike in combination with reduced metal demand, caused the drop in profits at Aluminum Company of Canada's large smelter at Arvida during the first nine months of 1957. Aluminum, Ltd., decided to postpone some expansion at Kitimat, B. C., but made no basic adjustments in its tremendous hydroelectric development program. Some of Alcoa's smelters were shut down by power shortages and Kaiser, too, closed one of its pot lines because of uncertain power supply.

Recently, Alcoa temporarily halted construction work on a smelter at Warrick, Ind., and on an alumina refinery and pot line addition at Point Comfort, Tex., and reduced the production of its Alcoa, Tenn., Point Comfort and Rockdale, Tex., smelters. It also curtailed bauxite mining and refining operations in Surinam, South America, and at Bauxite, Arkansas. The company has clearly pointed out that all these projects can quickly be put back into operation as soon as conditions warrant. Kaiser, on the other hand, in recent months increased capacity at both Chalmette, La., and Ravenswood, W. Va. Therefore, Kaiser currently has more capacity operating than it had a year ago.

This indicates aluminum veterans are not pessimistic about the oversupply. Faced with comparable situations in the past, the producers have concentrated on research to expand their market. Generally, the present decline in aluminum demand is considered to be temporary.

Interior of a Hardinge 11½′ x 12′ Rod Mill with 85-ton rod load, 1000 horsepower.

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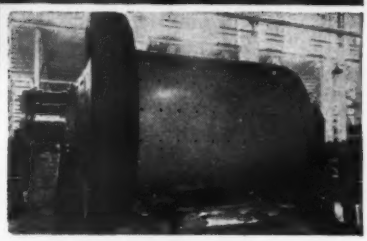
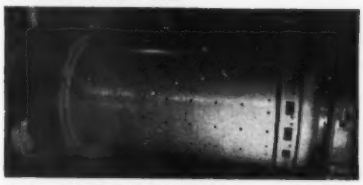


Trunnion overflow mill



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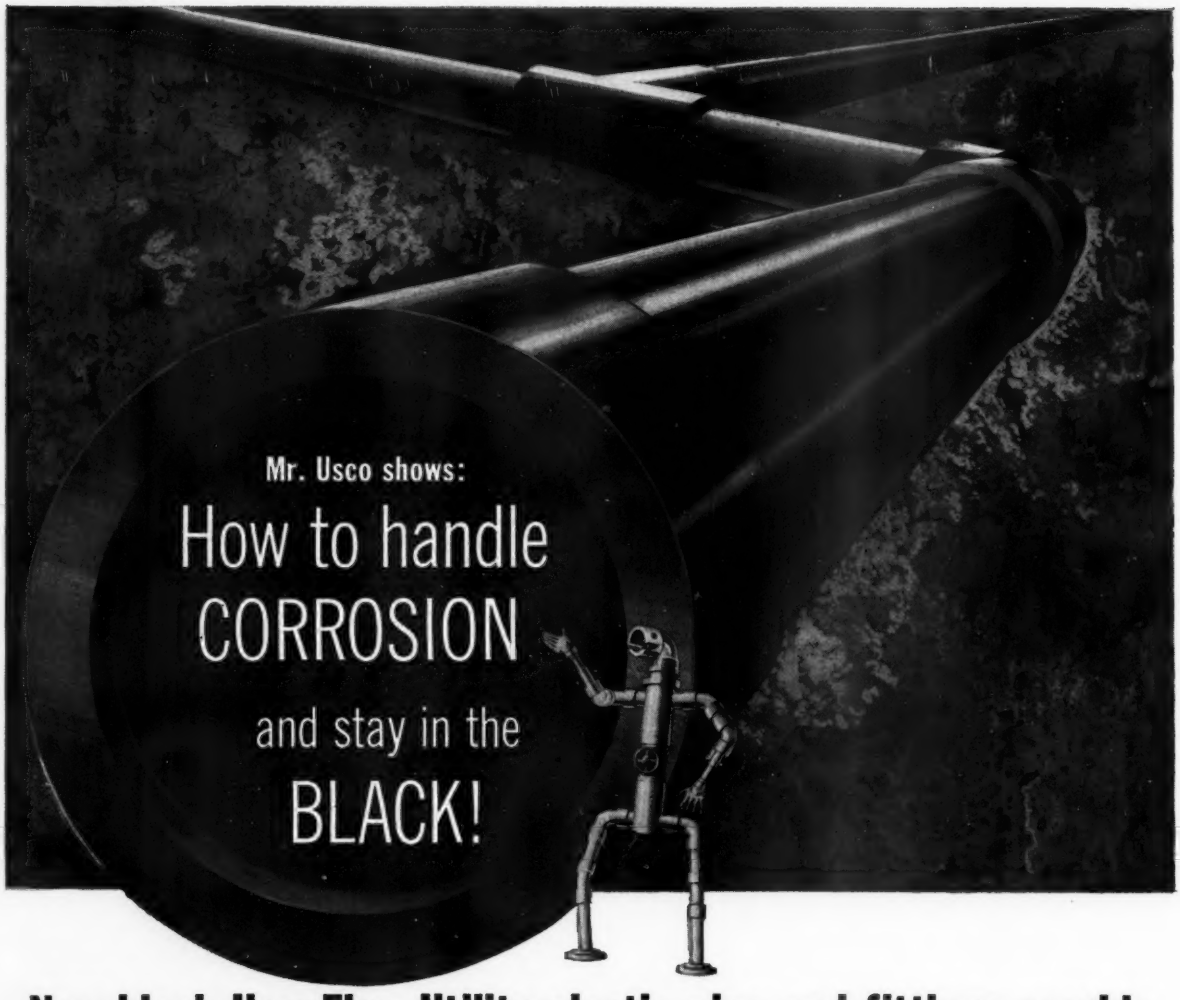

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A simple installation—rapidly solvent welded...

A friction-free finish that maintains high flow-rate and resists build-up of scale or other deposits...

An economical price to solve corrosion and high installation cost problems that would ordinarily chew into your profits...

All this is the *new* UscoFlow line of black plastic pipe and fittings, specially designed for economical and efficient handling of fluids. It has already proven its long service life, free of maintenance and downtime, and is recommended for such applications as

salt-water lines **fresh-water lines***
natural-gas lines **electrical conduit**

A full selection of UscoFlow pipe and fittings—plus expert engineering assistance—is available at any of the selected "U. S." Distributors, at "U. S." Branch Offices, or by contacting us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

**Uscolite is approved by the National Sanitation Foundation for use with potable water.*

Mechanical Goods Division

United States Rubber

See things you never saw before. Visit U. S. Rubber's new Exhibit Hall, Rockefeller Center, N. Y.

THE BALLAD OF THE TAX COLLECTOR

To Jacksonville Hing Foo came in,
He paid his tax with Chinese grin;
The "Foreign Miners Tax" said pay
Two dollars every month to stay.

The county clerk called Hing Foo "John"
And couldn't say when he had gone
Which Chinaman had paid his tax;
Then he went out to Hin Hong's shacks.

By Jackass Creek Hin Hong bowed low,
"Receipt says tax is paid, is so?"
The clerk agreed and went to Lin
Once more this routine to begin.

The same with Tan and Wong and Lo,
But which had paid he didn't know.
Next month again they pulled that trick
But had Poy paid or was it Chick?

The clerk just shrugged and said, "To me
There is no difference in Chinee."
Just how to make the heathen pay
Became the problem of the day.

"The Chinese fear a Klamath brave
More than they love the gold they save."
Said one, "The Ledford massacre
Still scares them into quite a stir."

So Tyee George was called to help
And with a chilling redskin yelp
They sent him down by Jackass Creek.
Poor Poy had not the breath to speak.

Hin Hong and Tan both shook with fear
And Lo passed out when George came near;
Hing Foo became at once quite ill
And I'm sure Wong is bowing still.

But by the time the day was done
The taxes were all paid—plus one;
And now when they recall that day
Those Chinese very gladly pay.

—Patricia Mahon

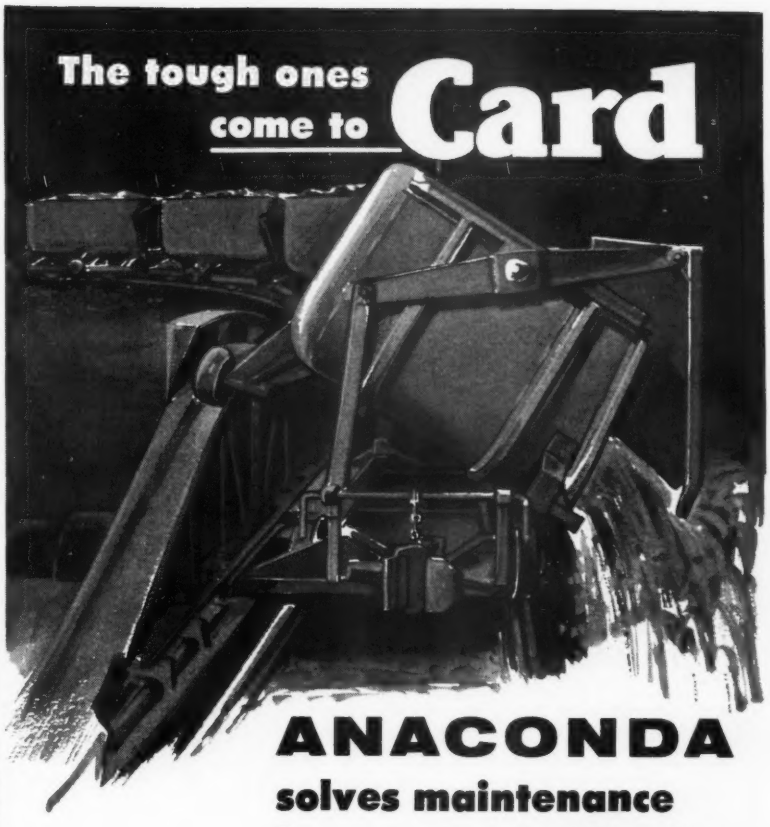
In early days, low grade gold placers in the West were worked by hardy Chinamen who made a living where others failed. Mrs. Patricia M. Mahon of Portland, Ore., has written a humorous account, describing the resourcefulness of a tax collector in dealing with the adroit oriental miners. (It is said to be based on a true account recorded in old mining records in Jackson County, Ore.)

Potash Mine to Cost $20,000,000

The board of directors of International Minerals & Chemical Corp. recently authorized expenditure of an additional $8,300,000 on the development of its new potash mine in Saskatchewan, Canada.

It is expected that the new mine, for which a 3000-ft shaft is now being sunk about 150 miles east of Regina, will ultimately cost in excess of $20,000,000. An allocation of $3,500,000 has already been made for the current fiscal year.

Louis Ware, president of IMC, said that the tentative program of development called for initial phases of production to begin in late 1959.



ANACONDA
solves maintenance by car standardization

Over 15 years ago, The Anaconda Company came to Card seeking the engineering of a side dump ore car that could serve a wide scattering of mine properties in Montana. Design requirements submitted by Anaconda called for long life in underground heavy-duty haulage and highly corrosive conditions.

About 1200 Card Granby-type cars are now in service in Anaconda's Montana operations. The latest designs differ in minor aspects from the original order, but all have proved highly satisfactory. The 115 cu. ft. car on 36" gauge has a high capacity to length ratio, keeping trains short. For maximum capacity, doors and back are internally braced. To ease loading shocks, the trucks are coil spring mounted, and the use of Card heat treated cast steel wheels with Timken bearings assure extended wheel life and easy haulage. Card engineers are happy to consult on any haulage problem. No obligation.

C.S. Card Iron Works Co.
2501 WEST 16TH AVE.
DENVER, COLORADO

lower YOUR COST per foot drilled

"ORIENTED" DIAMOND CORING BIT

Available in four different matrices and three different grades of correctly-sized diamonds. EX, AX, BX and NX sizes carried in stock. Larger sizes and special designs furnished to meet any specifications or requirements.

"M" SERIES "ORIENTED" DIAMOND CORING BIT

For use with "M" SERIES Core Barrel, when good cores must be secured from soft or friable strata. Available in all four types of matrix and three different grades of diamonds. Also in a complete range of impregnated sizes. EX, AX, BX and NX sizes carried in stock.

"ORIENTED" DIAMOND "TAPER" TYPE NON-CORING BIT

The fastest cutting bit for drilling blast holes in very hard formations. All standard sizes.

The one sure way you can do this is to specify or order Sprague & Henwood "Oriented" Diamond Bits. "Oriented" to give you better performance; and "Oriented" for minimum diamond loss. Thousands have been used in Sprague & Henwood's contract diamond drilling department, and thousands more have been supplied to its many customers. Completed contracts have produced lower costs and customers' re-order. Write for new Catalog No. 320-1 which gives the complete "Oriented" story, and illustrates and describes Sprague & Henwood's Diamond Bit Line.

RESETTING SERVICE

Send in your bits that need resetting, giving full details of results obtained and conditions under which the bits were used. Prompt, accurate and dependable service assures you that they will be returned new and with the diamonds "Oriented". Generally, reset bits are on their way back to the customer within three working days. In many cases, suggestions for improvements in bit performance can be made after inspection of your bits, provided full details covering their use have been received.

SPRAGUE & HENWOOD, Inc.
SCRANTON 2, PA.

Branch offices: New York • Philadelphia • Pittsburgh • Atlanta
Buchans, Newfoundland • Grand Junction, Colorado

Book Reviews

MINING ROUND THE WORLD

June Metcalfe, Oxford University Press, New York, N. Y., $2.50.

Highly readable literature on memorable conquests by the mining profession is uncommon. One of the most refreshing stories ever written on the subject is Mrs. Metcalfe's "Mining Round the World." It is unique in that it holds real interest for the miner as well as the layman —even including would-be miners of high school age or younger.

The author captures the mining viewpoint with historical accuracy and in language that is intelligible to readers who may be completely unfamiliar with the mining industry. Telling about projects such as the development of South Africa's diamond mines and the base metal operations at Bingham Canyon, Utah, and Broken Hill in the Australian interior, the book is a valuable contribution to public understanding of the mining industry.

REPORT OF INVESTIGATIONS 5375: A COMPARATIVE STUDY OF STATISTICAL ANALYSIS AND OTHER METHODS OF COMPUTING ORE RESERVES . . . United States Bureau of Mines, Washington 25, D. C.

The Bureau of Mines, in common with most of the mining industry, has been for many years acutely aware of the importance of sampling in mining and processing minerals and has carried out numerous investigations in this field. In recent years the mathematics and application of statistical analysis have received increasing attention by those concerned with sampling. Statistical methods have been applied in many industries with remarkable success. This highly significant report is the first in a new series of investigations on the theory of sampling with particular reference to application of the methods of statistical analysis.

This report includes a section on fundamental statistical analysis pertinent to the analysis of mine sampling. Although this may appear to be elementary to the statistician, it is recognized that statistical analysis is seldom used in the mining industry, and the elementary approach seems justified in presenting the subject. An attempt has been made to present all the necessary data in sufficient detail so that reference to a textbook on statistics will not be necessary to understand the methods used.

Most of the published papers describing statistical analysis related to mining have been reviewed and summaries are included. Some of the methods proposed in these papers have been used for computing the grade of the ore, so that the results can be compared when they are used on the same set of data.

manufacturers forum

TV Systems

CLOSED CIRCUIT television systems for industrial, commercial and military use has been announced by Insul-8-Corp., 1369 Industrial Road, San Carlos, Calif. Insul-8 Vicon systems include cameras, camera control unit, monitors and a wide range of accessories.

Two cameras are available. The larger Mark IV is designed for remote control operation, including: remote control of vertical and horizontal movement, remote control of focus and iris, and remote lens selection (the camera's rotating turret holds three interchangeable lenses). The smaller Mark II camera is for manual operation with one lens, where remote control is not required.

The camera control unit, which controls the camera and transmits its picture signal to the monitor, is distinguished by its modular construction. Various sub-assemblies plug into the unit, and can be replaced without stripping down the entire camera control unit. The control unit has two controls on the front panel—on-off switch and brightness dial.

Monitors are available in cabinet, rack mount, and portable models, ranging in screen size from 14 to 27 in.

Inquiries about new equipment appearing in Manufacturers Forum are welcomed. For additional information on any piece of equipment in this section write directly to the manufacturer, or to Mining Congress Journal with name of item and date of issue in which it appeared.

Automatic Line Oiler

WEIGHING 9 LB, this automatic line oiler reportedly feeds oil the instant drilling starts; the moment the oil supply is exhausted, the air supply to the air tool is shut off automatically. The oiler can be refilled while in operation, and oil flow can be adjusted without shutting off air pressure. Its one pint capacity is said to be more than adequate for one shift of operation. Top capacity is 300 cfm.

Additional information may be obtained by writing the Sales Promotion Department, LeRoi Division, Westinghouse Air Brake Co., Milwaukee 1, Wis.

Loading Machine

WITH AN OPERATING HEIGHT OF 25¾ IN., this loading machine has a rated capacity of four-six tpm and a tramming speed of 95 fpm. Designated as the 188-C Model, this machine reportedly is an improved version of the Pigloader 188 and is especially designed for use with shuttle cars. Features claimed include simplified design utilizing fewer parts and full independent crawler control. A single 40-hp electric motor drives all machine operations. For additional information, write the Long Co., P.O. Box 331, Oak Hill, W. Va.

Safety Shoe

THREE INDEPENDENT STEEL PLATES overlap up the front of this safety shoe to extend steel toe protection to the entire forepart of the foot. "Floating Bridge" over the ball joint flexes with the foot, permitting normal walking comfort, according to the manufacturer. Balljoint and instep shields have a vulcanized Neoprene coating that resists abrasion. Instep shield buckles over the lacing and cannot be removed from the shoe. Outsole and heel are oil-resistant Neoprene-cork. Shoes are available in widths D and E, sizes 8 to 13—Stock No. 1518—from Lehigh Safety Shoe Co., Emmaus, Pa.

Truck Crane

A 25-TON truck crane, the Model 100BT, has a choice of 6 by 4 ft or 6 by 6 ft chassis. Both sizes of the carriers have a detachable rear outrigger housing which allows gross weight to be reduced to conform to highway load restrictions. A live boom hoist, direct gear drive, conical hook rollers and fabricated machinery deck were also reported. The machinery deck is permanently rigged for all ordinary attachments, according to the manufacturer. Both manual and hydraulic counterweight removal systems are offered as options.

For further information, write Gar Wood Industries, Inc., Customer Service Department, Wayne, Mich.

Transformers

DRY-TYPE distribution transformers (DS-3 and DT-3) made by Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa., can be used outdoors by adding a pair of weather shields to each unit. Shields are available for all units rated 300 kva and below in the 600-volt class.

These shields — baffles of heavy gauge steel to keep out driving rain or snow—can be purchased separately and installed in the field by removing four panel bolts, and replacing them with the shields in place.

Hauling Unit

DESIGNED FOR UNDERGROUND OPERATION and other jobs where clearance and maneuverability are important, a low silhouette version of the 11-ton Model D Tournapull Rear Dump has been built by LeTourneau-Westinghouse Co. The unit's height is 8 ft 11 in. while hauling and 11 ft 8½ in. in dump position.

In addition to reduction in over-all height, the Lo Dump design incorporates a "squat" feature which permits lowering of the dump bowl to provide a loading height of 65 in.—said to be low enough to accommodate even the small tractor-mounted front end loaders.

With the exception of this ability to "squat" for loading and its lower over-all silhouette, the Lo Dump D retains the same basic operational features as the standard D Rear Dump.

For additional information write to LeTourneau-Westinghouse Co., Dept. 085, Peoria, Ill.

Boring Mill

FOR BORING, MILLING, FACING AND SCREW CUTTING, the Wotan No. B-85A Precision Horizontal Boring Mill has the following major specifications: Diameter of spindle, 3⅜ in.; taper in spindle, Morse No. 5; working surface of table, 38½ by 41¾ in.; maximum distance spindle sleeve to boring stay, 87 in.; number of spindle speeds, 21; number of feeds, 27; rapid traverse, 8 fpm.

Features claimed include: Power operated rotary table; nitrided roller bearing spindle; electro-magnetic clutches; rapid power traverse throughout; threading attachment; centralized lubrication and controls; vertical capacity, 36 in.; spindle to outboard support, 86 in.; speeds to 1000 rpm.

For further information contact Index Industrial Corp., 150 Broadway, New York 38, N. Y.

Detector

THIS TRANSISTORIZED M-Scope Locator, to be known as the "Explorer," has a fiberglass case, built-in battery testers, power selection control and detachable carrying belt. Due

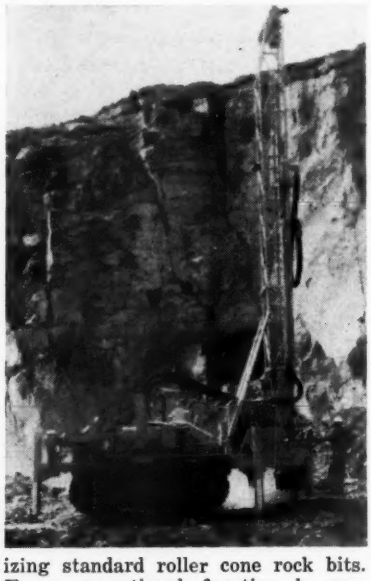
to the transitors, battery life in this unit is estimated to be 1500 hours of continuous operation. Operating weight complete is 12 lb. For more information contact Fisher Research Laboratory, Inc., Palo Alto, Calif.

Drill

FOR BLAST HOLE AND EXPLORATORY drilling, Portadrill, model 105TA, is now being introduced by Winter-Weiss Co.

The drill is mounted on an Eimco 105 Diesel Tractor with 125-143 hp. Two rotary vane compressors, furnishing 1000 cfm, remove the cuttings from the hole with normal pressures from 15-17 psi. Up to 50 psi are available for cleaning the hole in wet or sticky substances. Cuttings are controlled at the top of the hole by a deflector hood and a water spray system which protects both the crew and equipment from dust and cuttings. A cuttings collection system is also available for exploration or sampling work.

In sandstone, shales, limestone and other similar formations the 105TA reportedly has a rated capacity of 300 to 400 ft of 9 in. holes per shift util-



izing standard roller cone rock bits. Every operational function is controlled from an operator's panel located at the rear of the drill. Mast is raised and lowered hydraulically. Patented shock-hammer "break-out" tongs reportedly speed making or breaking of drill stem joints and an automatic constant feed system maintains down pressure on the bit. Drill is leveled and stabilized by hydraulic jacks. All power is supplied by the tractor engine through chain and gear type power transfer cases connected to the tractor through the front and rear power take-off shafts.

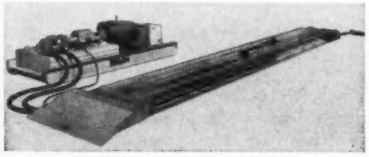
Complete specifications may be obtained from the Portadrill Division, Winter-Weiss Co., 2201 Blake St., Denver 5, Colo.

New Control Device

A SMALL, LIGHTWEIGHT transistorized d-c Servomechanism, that will provide a displacement output precisely related to a low voltage d-c input, has been developed by Advanced Research Associates, Inc., 4128-B Howard Ave., Kensington, Md. Although originally developed for use in aircraft, these units have potential application to any control use where rotary or linear motion is required. Its inventors point out that these servos are explosion proof because they are completely transistorized and make no use of relays. It is reported that they can control up to several hundred amperes of current and may provide the answer to control problems in mining operations using d-c.

Spotting Cars for Loading

AUTOMATIC LUBRICATION is one of the features claimed for the latest Nolan Hydraulic Porta-Feeder. The unit has pushbutton control from



both sides of the loading point with motor control switch, quick change dogs, removable wear slides, cushion spring anchor and spring cushioned dogs. Dogs operate on close centers for engaging mine car with V section draw bar. Detailed information may be obtained by writing to the Nolan Co., Bowerston, Ohio.

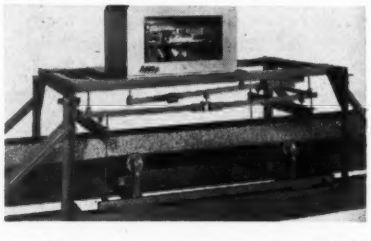
Shuttle Car

A SINGLE-MOTOR shuttle car for thin seam mining, the Type 30 Torkar is 30-in. high and has a capacity of 120 cu ft. A single a-c or d-c motor supplies all of the power, and a torque converter takes the motor output and transmits it to the constant-mesh transmission, which provides three speeds forward and reverse. The shuttle car also has four-wheel drive and steering. For further information write National Mine Service Co., 564 Alcoa Bldg., Pittsburgh 19, Pa.

Belt Conveyor Scales

FOR WEIGHING, controlling, and totalizing free-flowing bulk materials, a redesigned line of belt conveyor scales has been announced by ABC's Scale Division, McDowell Co., Inc., 16300 Waterloo Road, Cleveland 10, Ohio.

Utilizing mechanical linkages in both weight measuring and registering systems, the belt scales reportedly



are built to an accuracy of one-half to one percent of flow over their entire weight range. Units are available for any belt width, and are built from standard components. Any capacity is said to be available, to suit the capacity of the line in question.

ABC's scales, according to the company, can be equipped with any desired combination of remote controls, and can be used to control, blend and proportion materials flow.

—*Announcements*—

Appointment of **Earl A. Bradley**, formerly of **Joy Mfg. Co.**, to the post of general manager, Ashland Division operations, was announced recently by **National Mine Service Co.**

Vincent N. Burnhart, general manager of the **Longyear Co.** has been appointed vice-president, filling the vacancy created by the retirement of **Wesley Davenport.**

H. Richard Stickel has left his position as assistant to the president of **White Motor Co.** to enter the operating side of the business as executive vice-president with **Tose, Inc.**, Bridgeport, Pa.

H. R. Edelman, Jr., president of **Heyl & Patterson, Inc.**, has also been named chairman of the board.

Reich Bros. Mfg. Co., Inc. has established a Western Branch office at 1201 East 8th Street, Los Angeles 21, Calif. **Harlan K. Knudson** is in charge.

Walter McComb, vice-president and general superintendent of the **Flexible Steel Lacing Co.**, retired March 1. He had been with Flexible for 40 years.

George E. Stringfellow has been succeeded by **Robert H. Weeks, Jr.**, as vice-president and division manager of the Storage Battery Division, **Thomas A. Edison Industries.** Mr. Stringfellow continues as a vice-president and will devote his energies to the trade relations interests of Edison Industries as a whole.

A. J. Perantoni, who has been with the advertising department of **American Cyanamid Company's** Organic Chemicals Division since 1953, recently assumed new sales duties with the division's explosives department. He will be located at the division's sales headquarters in Latrobe, Pa.

Promotion of **Robert L. Williams** to advertising manager of **Gardner - Denver Co.** has been announced. He was formerly assistant advertising manager for the company's industrial products division.

CATALOGS & BULLETINS

V-BELT DRIVES. *Dodge Manufacturing Corp., Mishawaka, Ind.* This V-Belt manual contains all V-Drive information previously available in the company's full-line D-56 General Engineering Catalog. Tables have been expanded to include more pre-engineered drives. The 108-page book is packed with information on selection and operation of Dodge V-Belt drives. Its pages are arranged in sections covering standard, variable speed and special drives, taper-lock sheaves, sealed-life V-belts, and taper-lock bushings and hubs. Descriptive material is illustrated with product and installation photographs, engineering drawings and exploded views. Comprehensive tables of pre-engineered drives are included. Other tables give horsepower capacities, belt speeds, center distances, sheave diameters and other data when special drives are required.

CLEANING MACHINES. *Wheelabrator Corp., 1204 South Byrkit St., Mishawaka, Ind.* This 32-page illustrated catalog No. 951-D covers the company's entire line of airless blast cleaning machines as well as wet blast, air blast and dust control equipment. Also included are cast steel shot and grit abrasives, sandcutters and core rod straighteners. Listed for the first time is the line of Wheelabrator Super Tumblasts, a batch-type centrifugal blast cleaning machine. The catalog also contains reference to specific literature covering each of the individual pieces of equipment. All literature can be obtained by writing to Wheelabrator under company letterhead.

WEATHER PROTECTED MOTORS. *Allis-Chalmers, Milwaukee 1, Wis.* Features which contribute to the outdoor dependability of Allis-Chalmers weather-protected motors (Type FOD) built to NEMA and ASA standards in sizes NEMA frame 505 through 800 hp at 3600 rpm are described in Bulletin 51B8606B.

PUMP MOTORS. *Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio.* Reliance Totally Protected Pump Motors, from ⅛ to 1000 hp, are discussed in Bulletin B-2507. Photos and copy explain the features of the pump motors, which are designed and manufactured for pumps in all types of industries, wherever a prime mover of fluids is required. The bulletin explains the Reliance Partial Motor concept for attaching the machined motor frame directly to a pump frame to form an integrated unit.

MECHANICAL POWER TRANSMISSION AND CONVEYING MACHINERY. *Chain Belt Co., Sales Promotion Dept., Milwaukee 1, Wis.* Catalog 610 contains descriptions, specifications, application information and selection data on Chain Belt products for power transmission, conveying and elevating service.

ROTARY AIR COMPRESSORS. *Dept. A, American Brake Shoe Co., 530 Fifth Ave., New York 36, N. Y.* Said to be smaller and lighter than reciprocating compressors of equivalent output, these one-two hp pumps supply air in the 150-175 psi range. Folder explains principle of operation with cutaway diagrams, describes special features, and details operating and mounting specifications.

HYDRAULIC FLUIDS. *Vickers, Inc., Box 302, Detroit 32, Mich., Attention Advertising Dept.* Bulletin No. 1300 SA, "Selection, Operation and Maintenance of Hydraulic Fluids for Industrial Machinery," describes the characteristics of petroleum base and fire-resistant hydraulic fluids. It tells how to select the best fluid for a given job, how to care for it, and what to do about trouble when it occurs. One page is devoted to trouble shooting tips.

CLOSED CIRCUIT TELEVISION SYSTEMS. *Insul-8-Corp., 1369 Industrial Road, San Carlos, Calif.* Pamphlet No. V-1-58 gives descriptions of Vicon cameras, camera control, monitors, and accessories, with technical information confined to a "specifications" page. Illustrations feature the Camera Control, which consists of a plug-in sub-assemblies that can be removed and replaced individually.

SEAMLESS MECHANICAL TUBING TOLERANCES. *Sales Office, Tubular Products Division, The Babcock & Wilcox Co., Beaver Falls, Pa.* This technical data card, TDC-115D, furnishes data taken from the 1957 edition of the Steel Tubular Products Section of AISI Steel Products Manual. The card covers the important dimensional tolerances, both cold-drawn and hot-finished, of round, seamless carbon and alloy steel mechanical tubing in various conditions of heat treatment

SCRAPER. *Euclid Division, General Motors Corp., Cleveland 17, Ohio.* Entitled "Designed for a new era in earth-moving," catalog, Form 554, describes the Model TS-24 Twin Power Scraper and the development of the Twin-Power principle by Euclid—the use of two engines, each driving a separate axle through Torqmatic drives. Model TS-24 has a 300-hp diesel engine in the tractor and a 218-hp diesel engine mounted behind the scraper bowl. Independent use of the engines or four-wheel drive, whichever is needed, can be selected by the operator using a dual accelerator. Performance figures and condensed specifications are included to provide data on speeds, gradeability, engines, transmissions, tires, scraper controls, planetary drive axles, weights and dimensions.

(Continued on next page)

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BUCKET ELEVATORS. *Carpco Mfg., Inc., Jacksonville 6, Fla.* Specifications and important design features of Carpco Bucket Elevators are given in Bulletin BEB-101. The brochure highlights features which reportedly make the Carpco elevators practically jam-free and keep the belts cool running even when hot materials are being handled.

SINGLE-PHASE CHARGERS. *Advertising Department, C & D Batteries, Inc., Conshohocken, Pa.* Bulletin AR-100/58 covers the use, design and construction of the company's line of Auto-Reg Silicon Chargers for 12-volt electric industrial trucks. AutoReg chargers, using a silicon rectifier element, are single-phase chargers that can be plugged into any standard 115 volt a-c 60-cycle, single-phase convenience outlet.

PARTS WANT BOOK. *The White Motor Co., Service Sales Dept., Cleveland 1, Ohio.* White has available for its service and parts customers a new "Parts Want Book." The book has been designed for use by any fleet operator or truck user.

LIFT TRUCKS. Yale Materials Handling Division, The Yale & Towne Manufacturing Co., 11000 Roosevelt Blvd., Philadelphia 15, Pa. The Yale Worksaver line of rider-walkie trucks is described in this cutaway brochure. Using sectionalized views and a system of die-cut pages, the booklet pictorially disassembles the Worksaver to point out all its operating features. Yale Worksavers are produced in pallet, platform, stacker and tractor models.

DUST COLLECTOR. *The Ducon Co., 147 East Second St., Mineola, L. I., N. Y.* Bulletin No. A-9157 on dust collection equipment describes and illustrates Ducon's complete line of wet and dry type dust collectors and auxiliary equipment, including cyclones, centrifugal and dynamic washers, dust and fiber filters,

METAL CENTRIFUGAL PUMPS. *The Allen-Sherman-Hoff Pump Co., 259 East Lancaster Ave., Wynnewood, Pa.* Illustrated Brochure No. 657 describes the redesigned line of Hydroseal Sand and Dredge Type Metal Pumps for handling abrasive solids over four-mesh. Sizes range from 1½ to 14 in.; capacities up to 14,000 gpm.

COMPAR-A-FRAME. *Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio.* Bulletin B-1284-1 gives NEMA frame assignments and overall dimensions of Reliance a-c motors in NEMA frame sizes from 364U to 445U. The bulletin explains how to compare dimensions of the Reliance Series C motors with those of the Series D line (new NEMA frame sizes).

STEP LADDERS. *Ballymore Co., West Chester, Pa.*. Catalog No. 158 describes the pyramid design of step ladders for business and industrial use. The 20-page brochure illustrates 35 models for working heights up to 15 ft, gives specifications and shows typical uses. Also shown and described are other Ballymore ladders, hydraulic lifts and fixed or adjustable-level work platforms.

VIBRATING SCREEN. *Deister Machine Co., 1933 East Wayne St., Fort Wayne 4, Ind.* The 16-page catalog describes the four basic types of Deister Vibrating Screens designed to scalp or size coal, ore, slag and all types of screenable materials. It can serve as a handy guide to the selection of the proper type screen for all types of coal or metallic mining operations, according to the company.

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here's why NATIONAL Rewind Kits help you do a better job ...more easily, more quickly and more economically

1. Coils are of the highest quality . . . and each one fits exactly as it should.

2. Everything you need to do the job is conveniently packed right in one box.

3. All winding supplies reflect the latest in materials development and application.

4. Comprehensive, easy-to-follow placement and connection diagrams clearly explain the best winding procedure and technique.

For complete details on kits to meet *your* motor maintenance requirements, give your nearby National field engineer a call or drop us a line.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

"IN CASE OF EMERGENCY"

Mine emergencies happen without warning . . . and when they do happen, equipment that carries the "in case of emergency" label suddenly becomes vital to fire fighting and rescue efforts. Breathing protection devices are a major part of emergency mine equipment.

Below is a check list of this equipment offered by MSA. If you would like to make sure your emergency program is up-to-date, why not have our representative check your requirements and suggest a regular inspection and maintenance schedule.

M-S-A McCAA® Oxygen Breathing Apparatus—
gives complete breathing protection in any unbreathable atmosphere for a minimum of two hours. Used under the hardest physical conditions . . . in fighting and sealing fires, re-establishing ventilation, and rescue operations. U. S. Bureau of Mines approved.

M-S-A Chemox®—
allows complete breathing protection in any gaseous or oxygen deficient area for a minimum of 45 minutes. Generates its own oxygen supply from replaceable canister. Weighs only 13½ lbs. U. S. Bureau of Mines approved.

M-S-A All-Service Mask®—
assures safe, comfortable breathing protection against smoke and toxic gases including carbon monoxide—singly—or in combination where there is sufficient oxygen to sustain life. U. S. Bureau of Mines approved.

M-S-A Self-Rescuer®—
a miniature mask for use in deadly carbon monoxide following fire or explosion. Gives the miner precious minutes of emergency breathing protection. Unit is compact, lightweight; may be stored in quantity underground or carried individually. U. S. Bureau of Mines approved.

M-S-A Air and O_2 Mask—
designed for 30 minutes maximum breathing protection in any atmosphere—supplies air or oxygen in exact accordance with breathing requirements. Flow ceases during exhalation for added economy. Comfortable to wear and easy to use.

M-S-A Pneolator®—
provides automatic artificial respiration that assures maximum chances of recovery for victims of poisonous gases, electrical shock, heart attacks, or other causes of asphyxia. Housed in compact, lightweight glass fiber case.

MSA
SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES COMPANY
201 North Braddock Avenue, Pittsburgh 8, Pa.
At Your Service: 77 Branch Offices in the United States and Mexico

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